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Limnological Monitoring on the Upper Mississippi River System, 1993–1996: Long Term Resource Monitoring Program Bellevue Field Station

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Preface

The Long Term Resource Monitoring Program (LTRMP) was authorized under the Water Resources Development Act of 1986 (Public Law 99-662) as an element of the U.S. Army Corps of Engineers' Environmental Management Program. The LTRMP is being implemented by the Upper Midwest Environmental Sciences Center, a U.S. Geological Survey science center, in cooperation with the five Upper Mississippi River System (UMRS) States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The U.S. Army Corps of Engineers provides guidance and has overall Program responsibility. The mode of operation and respective roles of the agencies are outlined in a 1988 Memorandum of Agreement.

The UMRS encompasses the commercially navigable reaches of the Upper Mississippi River, as well as the Illinois River and navigable portions of the Kaskaskia, Black, St. Croix, and Minnesota Rivers. Congress has declared the UMRS to be both a nationally significant ecosystem and a nationally significant commercial navigation system. The mission of the LTRMP is to provide decision makers with information for maintaining the UMRS as a sustainable large river ecosystem given its multiple-use character. The long-term goals of the Program are to understand the system, determine resource trends and effects, develop management alternatives, manage information, and develop useful products.

In this report, limnological monitoring conducted by the Bellevue Field Station from 1993 through 1996 is summarized. Reports of this type provide a synopsis of the collected data and collection methods, as well as a preliminary report of remarkable or unusual conditions in the system. They are intended to be produced annually.

This report was prepared under Task 2.2.3.6, *Evaluate and Summarize Current Monitoring Results* of the Operating Plan (U.S. Fish and Wildlife Service 1993). This report was developed with funding provided by the Long Term Resource Monitoring Program.

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Abstract: Since 1988, the Long Term Resource Monitoring Program (LTRMP) staff have performed basic limnological field measurements in the Upper Mississippi River System. The period of this report (1993–96) includes a major revision of the LTRMP sampling design in 1993 that added randomization, broader spatial coverage, and increased monitoring of tributaries and locations that allow monitoring of material transport. Several short-term trends were noted during 1993–96. Total nitrogen, nitrate–nitrite nitrogen, soluble reactive phosphorus, total phosphorus, and turbidity generally decreased while ammonia increased in all study pools (12, 13, and 14). Sediment and plant nutrient concentrations were higher in two tributaries (the Maquoketa and Wapsipinicon Rivers, Iowa) than in the main channel of the Mississippi River.

Key words: Annual report, limnology, LTRMP, Mississippi River, water quality

Introduction

The Upper Mississippi River is a major resource of multiple uses that include navigation, water supply, hydroelectric generation, fish and wildlife habitat, and recreation. Effective management of this resource requires scientific understanding of the ecosystem and of its long-term trends and conditions. To meet this need, Congress authorized a Long Term Resource Monitoring Program (LTRMP) for the Upper Mississippi River System (UMRS). The LTRMP, begun in 1988, is intended to provide scientifically sound and useful information by using consistent and reliable methods to monitor and evaluate long-term changes in selected physical, chemical, and biological characteristics.

The LTRMP water quality staff collects basic information on selected physical and chemical features of the UMRS to aid in the interpretation or prediction of long- and short-term patterns. The data focus on a subset of limnological variables (i.e., physicochemical features, suspended sediment, and major plant nutrients) known to be significant to aquatic habitat in this system. The LTRMP is designed to complement, not replace or duplicate, the monitoring programs of other state and Federal agencies. It therefore includes some limnological characteristics not routinely monitored in water quality programs, and it excludes others that are of concern primarily for human consumption or regulatory purposes (e.g., chemical oxygen demand, biochemical oxygen demand, total coliform bacteria, fecal coliform bacteria, fecal streptococcus, heavy metals, pesticides, and polychlorinated biphenyls).

The present report is one in a series summarizing limnological monitoring at each of the LTRMP field stations. This report is intended to (1) document those aspects of sample collection (e.g., sampling times, period of record, sample locations, and allocations among strata) needed for valid interpretation of the data, and (2) report limnological conditions. Detailed analyses and interpretation of the limnological data are reported separately. This report covers multiple years.

To improve readability and increase the usefulness of this document as a reference, the many graphic and tabular summaries are included as appendixes. These appendixes are referenced extensively in the main body of the report, and each appendix contains explanatory information that allows it to be used as a nearly independent document.

The data presented here represent a concerted effort by personnel of the Iowa Department of Natural Resources and the U.S. Geological Survey who collected, compiled, verified, and organized the data. The specific data used in this report have been archived at the Upper Midwest Environmental Sciences Center (UMESC), La Crosse, Wisconsin (formerly the Environmental Management Technical Center, Onalaska, Wisconsin), and are available on request. This archival step isolates these data from the dynamics (additions and corrections) of the main LTRMP database and thus facilitates the reexamination, reconstruction, or expansion of the results presented here.

The Upper Mississippi River System

The basin of the UMRS (about 490,000 km^2) extends from north-central Minnesota to the Ohio River confluence near Cairo, Illinois. The enabling authorization for the LTRMP, however, restricts monitoring to the geological floodplain (about 2% of the total drainage). The LTRMP study areas include selected sections of the Mississippi River (Navigation Pools 4, 8, 13, and 26), La Grange Pool of the Illinois River, and the open river reach (Middle Mississippi River) between the Missouri River and Ohio River confluences (Figure 1).

Field teams of the LTRMP monitor more than 2,000 km of large river; across this expanse there exist distinct differences in climate, geomorphology, surficial geology, and land use. Patterns that arise from the north–south orientation of the system are overlain by upstream to downstream changes related to river size (Vannote et al. 1980). Consequently, the areas monitored by individual field stations differ markedly in the distribution and characteristics of aquatic habitat and aquatic biota. The LTRMP monitoring design must contend with these differences by being flexible enough to accommodate local conditions but appropriately uniform across all study areas to permit comparison and synthesis.

Dam construction on the Upper Mississippi and Illinois Rivers has profoundly altered these rivers, creating a series of rapidly flushed impoundments connected by short stretches of flowing river that are influenced by dam operations (Figure 2).

The dams on the main stem of the Upper Mississippi River are numbered from upstream to downstream (starting near St. Paul, Minnesota), and the river reach above each dam is called a pool (Table 1a). The pool has the same numeric designation as the downstream dam. For example, Pool 14, near Clinton, Iowa, includes the entire reach of river upstream of Lock and Dam 14 and downstream of Lock and Dam 13. A similar system is used on the Illinois River, but the individual dams are named rather than numbered (Table 1b). Although the navigation dams have created significant zones of permanent inundation in Pools 1–13 of the Upper Mississippi River, these zones are usually less than half the total water surface within the pool (LTRMP aquatic areas database) and are semifluvial (average hydraulic residence times

Figure 1. The Long Term Resource Monitoring Program (LTRMP) study area. Although the Missouri River is shown for reference, only the mouth of this tributary is sampled for water quality under the LTRMP.

<2 days). Between Pools 13 and 26 in the Mississippi River and in most of the Illinois River, the navigation dams have deepened the river and widened it slightly, but have permanently inundated little terrestrial area compared with major river impoundments and have created minimal lake-like habitat. The term pool is therefore misleading inasmuch as it suggests that the UMRS is a stair-step series of lake-like impoundments. Nonetheless, the term is widely used and recognized by those familiar with the UMRS and it is used freely in this report.

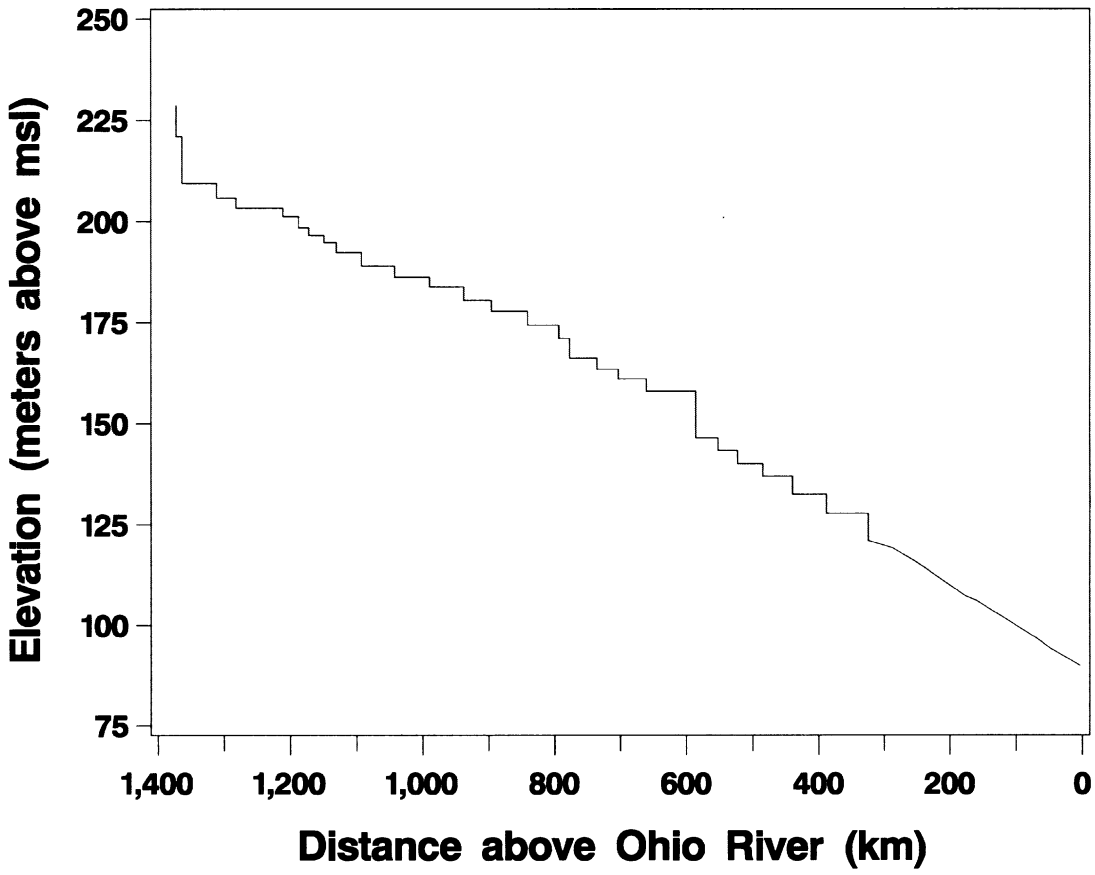

Figure 2. Water surface elevation (meters above mean sea level) of the Mississippi River from the head of navigation near St. Paul, Minnesota, to the confluence of the Ohio River near Cairo, Illinois.

The first major dam on the Upper Mississippi River was constructed in 1913 near Keokuk, Iowa, and was followed by 27 additional dams on the main stem to create a 2.7-m (9-foot) navigational waterway from Alton, Illinois, to St. Anthony Falls near St. Paul, Minnesota. Twenty-two dams were built between 1935 and 1940; the last dam was completed in 1958 at Lower St. Anthony Falls near Minneapolis (Table 1a). The navigation system was altered significantly in 1993 when Lock and Dam 26 at Alton was replaced by a new structure (Melvin Price Locks and Dam) with increased lock capacity about 3.2 km (2 miles) farther downstream. The previous Lock and Dam 26 was removed after the new structure was completed.

The history of impoundment on the Illinois River is similar to that of the Upper Mississippi River, and the Illinois River is now divided into six navigational pools (Table 1b). The first dams were completed on the upper portions of the Illinois River (Starved Rock, Marseilles, and Dresden Island) in 1933; additional dams at Peoria and La Grange were completed in 1938. The Melvin Price Locks and Dam on the Mississippi River near Alton, Illinois, also impounds the lowermost portion of the Illinois River.

Table 1a. Dams on the Upper Mississippi River.

Name of dam	Date placed in service	City	River mile	Drainage area (km^2)	Dam height (m)	Pool elevation (feet)
Lower St. Anthony Falls	11/13/1958	Minneapolis, Minnesota	853.2	51,000	7.3	750.0
1	07/03/1917	St. Paul, Minnesota	847.6	51,000	11.3	725.1
2	07/01/1931	Hastings, Minnesota	815.2	96,000	3.7	687.2
3	07/21/1938	Red Wing, Minnesota	796.9	117,000	3.7	675.0
4	05/25/1935	Alma, Wisconsin	752.8	148,000	2.4	667.0
5	05/29/1935	Minneiska, Minnesota	738.1	152,000	2.1	660.0
5a	07/06/1936	Winona, Minnesota	728.5	153,000	2.7	651.0
6	06/30/1936	Trempealeau, Wisconsin	714.3	155,000	1.7	645.0
7	04/19/1937	Dresbach, Minnesota	702.5	161,000	2.0	639.0
8	04/26/1937	Genoa, Wisconsin	679.2	168,000	2.4	631.0
9	07/08/1937	Lynxville, Wisconsin	647.9	172,000	3.4	620.0
10	11/26/1937	Guttenberg, Iowa	615.1	206,000	2.7	611.0
11	09/14/1937	Dubuque, Iowa	583.0	211,000	2.4	603.0
12	05/14/1939	Bellevue, Iowa	556.7	213,000	3.4	592.0
13	05/13/1939	Clinton, Iowa	522.5	221,000	2.7	583.0
14	06/14/1939	Le Claire, Iowa	493.3	229,000	3.3	571.9
15	03/07/1934	Rock Island, Illinois	482.9	229,000	4.9	561.0
16	07/10/1937	Muscatine, Iowa	457.2	257,000	2.7	545.0
17	05/14/1939	New Boston, Illinois	437.1	258,000	2.4	536.0
18	09/08/1937	Burlington, Iowa	410.5	294,000	3.0	528.0
19	06/12/1913	Keokuk, Iowa	364.2	308,000	11.6	518.2
20	06/09/1936	Canton, Missouri	343.2	348,000	3.0	480.4
21	07/21/1938	Quincy, Illinois	324.9	348,000	3.2	470.0
22	07/22/1938	Saverton, Missouri	301.2	356,000	3.1	459.5
23[a]	—					
24	1940	Clarksville, Missouri	273.4	365,000	4.6	449.2
25	05/18/1939	Cap Au Gris, Missouri	241.4	368,000	4.6	434.9
26[b]	05/01/1938	Alton, Illinois	202.9	443,000	6.7	419.0
Melvin Price	1990-1994	Alton, Illinois	200.8	444,000	7.3	419.0

[a]Lock and Dam 23 was never built.
[b]Lock and Dam 26 was removed after the Melvin Price Dam was placed in service.

Table 1b. Dams on the Illinois River.

Name of dam	Date placed in service	River mile	Drainage area (km^2)	Dam height (m)	Pool elevation (feet)
Thomas J. O'Brien[a]	1960	326.5	0	1.2	583.5
Lockport	1933	291.1	1,900	12.3	579.5
Brandon Road	1933	286.0	3,900	10.4	539.0
Dresden Island	1933	271.5	18,800	6.7	505.0
Marseilles	1933	247.0	21,400	7.3	483.0
Starved Rock	1933	231.0	28,600	5.8	459.0
Peoria	1938	157.7	37,700	3.4	440.0
La Grange	1939	80.2	66,400	2.9	429.0

[a]This structure controls diversion discharge into the Illinois waterway from outside the drainage basin (Lake Michigan).

Methods

Study Area

The study area of the LTRMP includes the Mississippi River from Cairo, Illinois, to the head of navigation near St. Paul, Minnesota; the Illinois River; and navigable portions of the Kaskaskia, Black, and St. Croix Rivers. In recognition of the highly variable and widely differing river characteristics within this large study area, the Comprehensive Master Plan (Jackson et al. 1981) recommended 17 pools or reaches for detailed monitoring. Available resources, however, have limited the LTRMP to six selected areas, and the five states bordering the Upper Mississippi River now operate six LTRMP monitoring stations that focus on these specific reaches. These areas (Figure 1) are concentrated in the uppermost segments of the Mississippi River. The river sections presently monitored under LTRMP for water quality include Pools 4, 8, 9, 12, 13, 14, and 26 in the impounded portion of the Upper Mississippi River; 130 km (80 miles) of the open river above the Ohio River confluence at Cairo, Illinois; and La Grange Pool of the Illinois River. All of the major tributaries of the Mississippi and Illinois Rivers in these river segments are monitored under the LTRMP. The long (400 km) reach of the Upper Mississippi River between Pools 14 and 26 is not monitored under the LTRMP, but other state and Federal programs collect water quality information in this reach and adjoining tributaries (i.e., Iowa-Cedar, Rock, and Des Moines Rivers). In the nonbraided portion of the Upper Mississippi River main stem (between Pools 14 and 26), sampling under the LTRMP is limited to the extreme upstream and downstream ends. However, the Mississippi River main stem and its tributaries in this reach are monitored by other state and Federal programs. Staff of the Iowa Department of Natural Resources Mississippi River Monitoring Station office in Bellevue, Iowa, conduct LTRMP monitoring in the vicinity of Pool 13, defined by Lock and Dam 13 at Mississippi River mile 522.5 and Lock and Dam 12 at Mississippi River mile 556.7, as well as Pool 12, Pool 14, and selected tributaries (Figure A-1). Water quality has been monitored since 1988 (Appendixes A and B).

The total water surface area of the pool (between Lock and Dam 12 and Lock and Dam 13) is 11,183 ha (27,636 acres), with 9,600 ha (23,756 acres) of backwater and 1,570 ha (3,880 acres) of main channel. This reach of river exhibits braided-channel morphometry and has a diverse mosaic of backwaters, side channels, and other aquatic areas.

The floodplain in the vicinity of Pool 13 is dominated by open water habitats and aquatic vegetation and has low agricultural use. The vast expanse of lower Pool 13 is an important resting area for migratory waterfowl and supports one of the largest documented populations of fingernail clams (Sphaeriidae) in the Upper Mississippi River.

In 1992, the exotic zebra mussel (*Dreissena polymorpha*) was first documented in Pool 13, and, during this study period (1993–96), became well established in the region. Zebra mussels can have multiple effects on water quality and riverine biota. Their high capacity for filtering can effectively remove plankton and other particulate material from the water, thus reducing turbidity and competing with other particulate feeders. By removing oxygen-producing phytoplankton from the water, by consuming oxygen in their own respiration, and by the decay of their fecal material, zebra mussels may significantly alter the oxygen regime. Close monitoring is needed to evaluate these effects.

Monitoring Network and Sampling Design

The LTRMP was begun in 1988; field stations were added to the network from 1988 to 1991 (Table 2). This staggered start is significant when making comparisons among study areas or assessing overall trends across the system. Limnological monitoring during the first years (1988–91) was limited to fixed sites and to in situ physical and chemical measurements. The present LTRMP sampling design (implemented in June 1993) includes both fixed-site (Appendix A) and stratified random sampling (SRS; Appendix B) and combines in situ field measurements with laboratory analyses of chemical constituents (Appendix C).

Table 2. Period of operation for each of the Long Term Resource Monitoring Program field stations.

Field station	1988	1989	1990	1991	1992–1996
Lake City			Jan		
Onalaska	Jul				
Bellevue	Aug				
Pool 26	Jul				
Open River				Mar	
Havana		Sept			

Fixed-site sampling in the present design monitors inflows (tributaries and dam releases) and outflows from each of the LTRMP study areas. Secondarily, fixed sites are used to monitor locations of special significance, either because of their long data record or some other feature that makes them notable or especially interesting. Each LTRMP field station monitors about 15–30 fixed sites biweekly with no attempt to capture or avoid high or low flows (Appendix A).

From 1988 to 1993, the LTRMP used 24 aquatic habitat classes (Appendix A) to describe the permanently fixed monitoring sites. Some of these classes included a seasonally varying attribute (aquatic vegetation) as part of their definition, and the classes were not mutually exclusive. For example, a site in midchannel downstream of a dam might be classified as "Main Channel" (MC), "Channel Trough" (CTR), "Open Tailwater" (TWR-O), or "Tailwater" (TW). This classification scheme was revised in 1993 when vegetation status was dropped from the habitat designators and those categories that were viewed as redundant or not

distinguishable by routine water quality measurements were eliminated. The revised system has seven habitat classes (Table A-4), and all previous habitat classifications for fixed sites were converted to this system. The original designations for all fixed sites are permanently on file at UMESC and at the individual field stations.

As with the six field stations, the period of record differs among individual fixed sites. When the emphasis of fixed-site sampling shifted to tributaries and other transport monitoring points in 1993, sites were added and eliminated from the sampling network in each study reach. At the same time, sampling frequency at fixed sites was reduced from weekly to biweekly (Figure A-2) to keep the overall level of monitoring constant despite the addition of SRS.

The habitat class associated with each fixed site provides useful ancillary information about the site and a convenient way to retrieve data from the LTRMP database. However, LTRMP fixed-site data cannot be used generally to make inferences about these habitat classes because fixed sites were chosen subjectively and without randomization and represent only specific locations. Although the sampling sites can be grouped by their habitat categories, the resultant groupings are not unbiased samples of these categories. To overcome this limitation, the monitoring design was modified in 1993 to include SRS and thus provide unbiased information about broad spatial areas.

The LTRMP design for fixed-site sampling and SRS, established in September 1993, requires that each day's sampling effort be centered on noon (1200 h), central standard time, and that the order of site visits within each sampling day be randomized to the extent feasible within operational constraints.

The SRS complements the fixed-site design and provides a seasonal assessment of known precision and confidence on limnological conditions in broad sampling strata in the LTRMP study areas. Limnological data from SRS are intended to be linked to patterns in fish, vegetation, and invertebrates at the spatial scale of a whole navigational pool or river reach and at temporal scales ranging from seasons to decades. The SRS data can be interpreted confidently at these scales of space and time. Higher resolution questions (e.g., short-term movements or locations of fish, growth dynamics within individual aquatic plant beds) are outside the realm of routine monitoring as defined by the LTRMP and are not addressed by SRS or fixed-site sampling in the LTRMP monitoring design.

The SRS is performed in four quarterly episodes each year (Appendix B). In each SRS episode, about 150 sites are randomly selected from six sampling strata and sampling is usually completed within 14 days (Appendix B). The sampling strata are condensed from the geomorphic “aquatic areas” of Wilcox (1993) and are objectively defined in a geographic information system (Owens and Ruhser 1996). Specific sampling points for each sampling episode are selected by overlaying a square grid with 200-m spacing on a map of the sampling strata. Grid intersections are randomly selected for each sampling episode. Beginning in spring 1995, a 50-m grid was used for side channel and backwater strata. A smaller grid spacing was deemed appropriate to the spatially diverse conditions within these strata (i.e., points 50 m apart are likely to be different); this increases the number of potential sites available for site selection. Although the number of sites selected was not altered by this change in grid spacing, the number of locations resampled in subsequent episodes was greatly reduced. The allocation of samples among strata emphasizes off-channel areas and is not proportional to the surface area of the strata (Appendix B). Data from the strata must be weighted to obtain accurate pool- or reachwide estimates, and this weighting must account for the areas of the strata, the differing grid intervals among the strata, changes to the grid in 1995, and the allocation of sampling effort (Appendix B).

The sampling strata used by the LTRMP are primarily a statistical tool that allows the spatial allocation of sampling effort to match differences in desired precision and variability among the strata. An exact

correspondence between sampling strata and the aquatic areas of Wilcox (1993) is not attainable and is not required by the LTRMP statistical design. The data from a sampling stratum, therefore, should not be regarded as precisely representing a specific aquatic area type.

Because the river is dynamic, the borders of the aquatic areas change over time, but the sampling strata boundaries have been (with minor exceptions) static since their original designation in 1993. Thus, the aquatic areas are expected to gradually diverge from the sampling strata because of long-term changes in river morphology. In addition, short-term fluctuations in water level can make sites unusable or atypical of their parent stratum. The field teams use data comments to report sites that cannot be sampled or seem to be outside their designated sampling stratum. These comments are extremely valuable for data interpretation and also give a rough indication of the rate or extent of divergence between the sampling strata and the aquatic areas. However, field comments lack the spatial intensity and consistency required for tracking or mapping changes in stratum boundaries, and the LTRMP staff intend to track changes in aquatic areas by systemwide remapping and reclassification of areas at regular (e.g., 10-year) intervals. If future remapping results in new sampling strata, all sampling locations will have both pre- and postrevision stratum codes assigned. This will allow analysis for the full period of monitoring to be based on either mapping scheme.

The capacity of the LTRMP analytical laboratory has restricted the number of chemical measurements performed on SRS samples. Consequently, from 1993 to 1996, SRS has included major plant nutrients, suspended solids, and phytopigments, but has excluded major cations (sodium, magnesium, calcium, potassium) and major anions (chloride and sulfate). In situ measurements are made at all SRS sites; to reduce the laboratory sample load, samples are collected for a full complement of laboratory analyses only in a randomly selected subset (about half) of sites.

Sample Collection

The LTRMP limnological monitoring includes measurements at multiple depths (Soballe and Fischer 2003). About 80% of LTRMP measurements from 1993 to 1996 were taken near the water surface (0.0 to 0.20 m); laboratory analyses during this period were performed only on near-surface and near-bottom samples. The LTRMP sampling for water quality is generally restricted to waters at least 0.2 m deep or deeper. However, samples are occasionally collected in shallower waters, particularly under ice cover, when they can be taken without disturbing the substrate. Discrete, rather than integrated, samples are collected and analyzed. Grabs for chemical analyses are taken with either a bucket (near-surface) or a Van Dorn sampler (at depth).

When the sampling design was revised in 1993, grab-sampling techniques remained unchanged; however, individual instruments used to monitor pH, conductivity, temperature, and dissolved oxygen were replaced by a multiparameter monitoring device used for in situ measurement and recording. The LTRMP Procedures Manual (Soballe and Fischer 2003) provides additional details.

Ice cover can vary widely in extent and thickness across the study area, complicating sample collection and the recording of sample information. It is not meaningful, for example, to report limnological conditions at 0.2 m below the water surface when the ice extends below this depth, nor to report maximum water depth when ice extends into the substrate. Consequently, when ice is present, LTRMP crews collect near-surface samples at 0.2 m below the bottom of the ice (where possible). The reported sampling depth in this situation (0.2 m) must be adjusted for the vertical extent of ice below the water surface (also recorded) to determine the actual vertical location of the sample in reference to the free water surface. Here we summarize the data by depth sampling category rather than precise vertical location; the sampling depths have not been adjusted

for the vertical extent of ice below the water surface. In addition, sites that were frozen to the substrate have been excluded from the summaries of water depth.

Laboratory Analyses

The LTRMP added a limited suite of laboratory analyses to the limnological monitoring in 1991 and expanded the list of chemical constituents in 1993 (Appendix C). From 1991 to 1993, samples for chemical analyses were collected biweekly during the ice-free period; this frequency was reduced to monthly in winter. Also during this period, chemical analyses were performed at the Waterways Experiment Station (WES) laboratories at Vicksburg, Mississippi, and the U.S. Army Corps of Engineers Eau Galle laboratory near Spring Valley, Wisconsin. In 1993, analysis of LTRMP limnological samples was gradually shifted to the UMESC (Table C-2).

In late summer and fall 1996, the UMESC analytical laboratory experienced contamination in its total phosphorus analyses. The problem was eventually identified and eliminated in December 1996; those analytical results affected by this contamination have been excluded from this report and are identified in the LTRMP database. The laboratory also experienced ammonia contamination in May 1996, which invalidated many of the ammonium samples collected in the spring 1996 SRS episode. Those data have also been excluded from this report. Detailed descriptions of the methods used by the UMESC and WES laboratories are available on request from the UMESC in La Crosse, Wisconsin.

Quality Assurance and Quality Control Procedures

The value of LTRMP data depends on their quality and reliability. The use of standard methods to assure and control the quality of the data are thus extremely important. The original LTRMP procedures (Lubinski and Rasmussen 1988) gave guidance on instrument calibration, record keeping, data management, and organizational relations. Revisions to the procedures (Soballe and Fischer 2003) provided details on assessing the accuracy and precision of field measurements and laboratory determinations and also addressed issues (i.e., daily and seasonal sampling windows, randomization of sampling sites and times) related to the conduct of field work. Guidelines for the time of sampling and randomization of sampling order were implemented in 1993, and compliance with these guidelines is reported here (Appendix D).

The LTRMP field teams began collecting additional Quality Assurance and Quality Control (QA/QC) measurements and samples near the end of April 1995 to assess the accuracy and precision of both laboratory and field measurements. The QA/QC sampling data are readily available (http://www.umesc.usgs.gov/data_library/water_quality/water_quality_page.html), but not summarized here.

Following the recommendations of APHA (1992), at least 5% of each type of chemical or physical measurement collected by an LTRMP water quality team is accompanied by a series of QA/QC measurements, and each sampling crew is required to perform at least one QA/QC series during each day of field work. The daily crew requirement results in about 15% of all samples being accompanied by QA/QC measurements, exceeding the APHA recommendation and LTRMP minimum requirement. Because of logistic constraints, the LTRMP did not use field spikes (additions of known concentrations of chemical constituents)in 1993–96, but did collect four types of QA/QC samples:

Routine: The regular or routine sample or measurement taken at the site.

Field split: A field sample that is as similar as possible to the routine sample at the point of collection. It is used to evaluate laboratory precision and variability introduced by field handling or processing. Field splits are performed for all the constituents listed in Table C-2 that are presently analyzed.

Blank: A sample used to check for contamination of the analytical water supply or sample containers, or contamination and losses during handling and storage. It is also used to evaluate precision at concentrations near the detection limit.

Replicate: A second, separate sample taken at the same location and in the same way as the routine, but separated by an interval of 5–10 minutes. This provides information on natural, random background variability in ambient conditions.

Results

River Discharge Regime

River discharge (flow) is a major factor in the ecological and limnological structure and functioning of the UMRS. Flow strongly influences limnological conditions and, thus, the interpretation of the monitoring data must consider the hydrologic setting (flow regime) under which the data were collected. Because river discharge is so important, staff of the LTRMP have assembled the Mississippi and Illinois Rivers discharge and surface elevation data collected by the U.S. Geological Survey and the U.S. Army Corps of Engineers into a database at the UMESC (Wlosinski et al. 1995). The discharge and water elevation data used in this report were obtained from that database.

Water levels at the Lock and Dam 12 tailwater gage (Figure 3) represent the hydrologic regime in the Pools 12–14 study area. Flood stage at this gage is 182.03 m (597.20 feet) above mean sea level. Water levels at this site reflect the large, late-season flood of 1993 and indicate that water levels during the entire reporting period have generally been above the 56-year average but usually below flood stage. Flood stage was reach only three times during the study period (twice in 1993 and once in 1996). In general, the hydrograph is dominated by a high flow period in spring with a smaller rise in fall. Summer and winter periods are characterized by low water levels. Summer and fall water levels have been substantially elevated above average during the reporting period, which has probably influenced the limnological data. Weekly fluctuations of 1–2 m are not uncommon for Pool 13.

Fixed-site Sampling

Sample Collection and Field Measurements

The volume of field work completed by each field station is important to document for planning and budgetary purposes. The schedule of sample collection is also important to report because many of the limnological characteristics monitored by the LTRMP exhibit regular daily (diel) patterns. The time of measurement can thus strongly influence the value that is observed and, because the LTRMP strives to monitor patterns over time across the UMRS, it is important that sampling times be consistent and unbiased over time, among sampling locations, and among field stations.

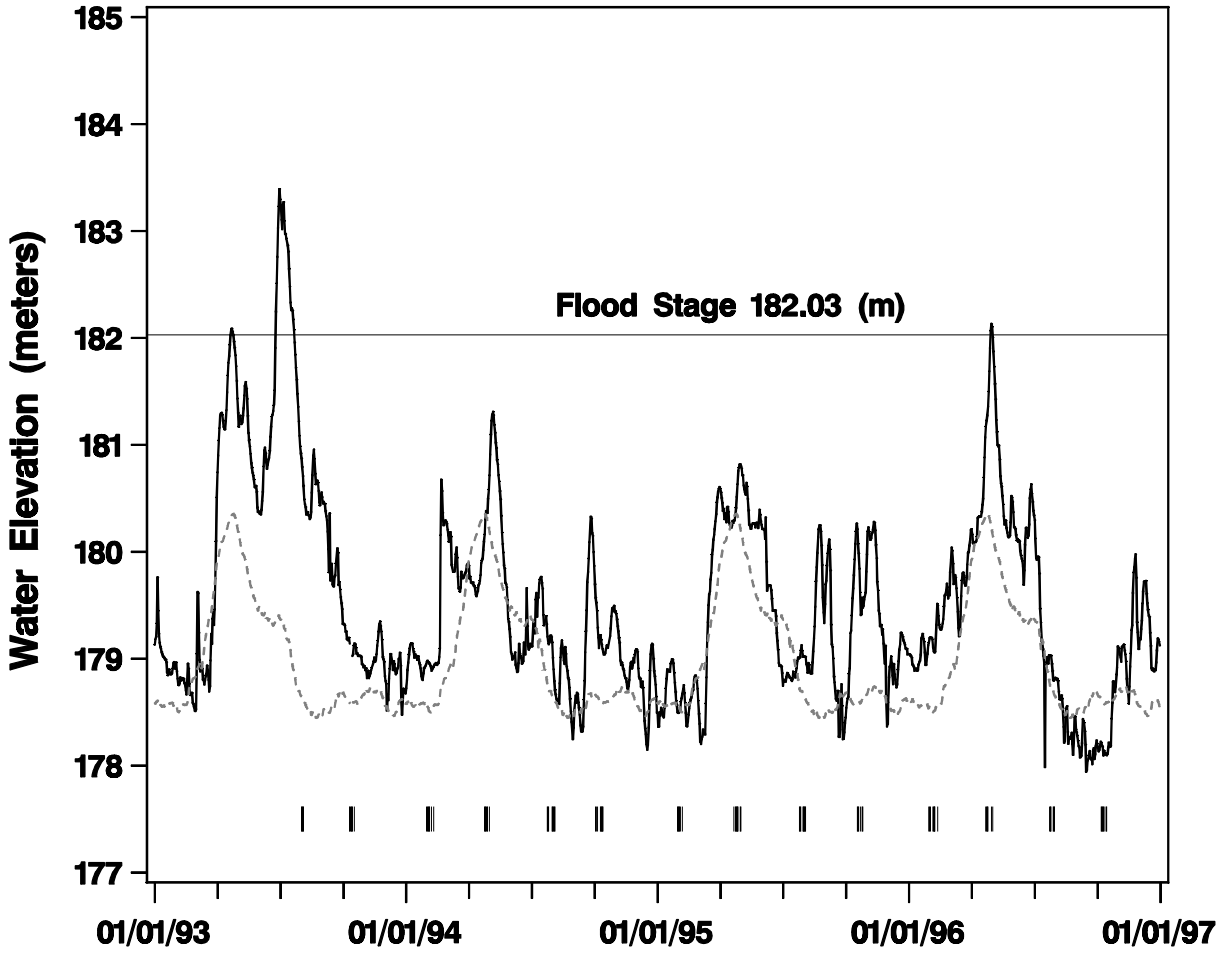

Figure 3. Water elevation (meters above mean sea level) at Lock and Dam 12 tailwater from 1993 through 1996 (*solid line*) and the 1940–1996 average annual hydrograph (*dashed line*). Vertical lines above the horizontal axis indicate dates of stratified random sampling. Water elevation for flood stage is indicated by the horizontal line.

In 1993–96, the Bellevue water quality team made about 1,900 site visits to fixed sampling locations. During these visits, about 1,500 grab samples were collected for chemical processing (Appendix E).

Although the number of site visits during a week of sampling was typically about 15–16, sampling often spanned a weekend (Figure D-1 and Table D-1). The 1993 sampling redesign reduced the number of weekly fixed-site visits from 26 to 16 (Figure D-1).

Median sampling time (Figures D-2–D-4) showed little effect from the September 1993 change in the fixed-site sampling protocol because the Bellevue Field Station already centered most sampling around noon. However, the effect of the new sampling window definition decidedly narrowed the distribution of sampling times (Figure D-2). Fixed-site sampling generally complied well with the LTRMP design, but a seasonal pattern has emerged in the sampling times, with a tendency to sample later in late winter and early spring, and earlier in summer. The linear trend in sampling time at the fixed sites was not statistically significant ($P = 0.10$).

The distribution of median sampling times for sites (Figure D-4) is parallel to that for samples (Figure D-2). In 1993, the median sampling time varied substantially among sites (Figure D-4) and most sites were sampled consistently in the morning. After noon-centered sampling was implemented in 1993, the median sampling times in 1994 and 1995 were tightly grouped around noon (Figure D-2).

Fixed-site Sampling Data

Fixed-site sampling by Bellevue Field Station staff from 1993 to 1996 has generated a large volume of data (Appendix E). These data allow comparisons of tributary and main-stem inflows and outflows within this study area and thus provide information on sources of material such as nutrients and suspended sediment and the functioning of the study reach as a processor of those materials.

The fixed-site data reveal important aspects of the three navigational pools and tributaries in this study area. For example, the data suggest a long-term decline in the concentrations of total and nitrate–nitrite nitrogen as well as total and soluble reactive phosphorus (Figure E-2). When coupled with steady-to-declining flows (Figure 3), a significant decline in the transport of these materials in this reach is suggested. Detailed loading calculations are needed to verify this apparent trend. Ammonia appeared to increase during this period without a readily apparent cause.

Tributaries in this study reach seem to have detrimental effects in the receiving waters of the Mississippi River. The monitored tributaries are much higher in nitrogen, phosphorus, suspended solids, and turbidity than the main channel of the Mississippi River. All the monitored tributaries exhibit spring turbidity maxima coincident with increased agricultural activity, snow melt, and higher rainfall.

The increase in turbidity and suspended solids from upstream to downstream in Pool 13 (Figure E-2) indicates that this reach (and its adjacent watershed) overall is a significant source of sediment to the system. The Maquoketa River enters Pool 13 near midpool and carries suspended solids and turbidity at levels more than 10 times that in the main channel of the Mississippi River (Appendix E). The influence of the Maquoketa River and other tributaries is evident from the higher (clearer) Secchi transparencies in upper Pool 13 than downstream (Figure E-1).

The fixed-site data (Appendix E) show the strong seasonality of flow-related parameters (e.g., turbidity, Secchi transparency, suspended solids, total phosphorus, nitrogen species). Nitrate, ammonium, and silicate concentrations peaked in the tributaries in late winter and early spring, but these patterns are less distinct in the main channel. In backwaters, ammonium nitrogen concentrations peaked in January and February when backwater sites are generally ice covered and ammonium can accumulate from the decay of organic material (e.g., dead fish, vegetation, and algae). Elevated ammonium concentrations may stress fish populations that congregate in backwaters in winter.

Dissolved oxygen saturation is a function of water temperature and thus shows strong seasonality at all sites. Monthly means do not show the extremes in dissolved oxygen, and the LTRMP sampling schedule (centered on noon) does not give a good representation of extremely low (expected near sunrise) or high (expected in mid- or late afternoon) oxygen concentrations.

Sample Collection and Field Measurements

As in fixed-site sampling, the number and frequency of samples collected and the scheduling of sample collection in SRS is important for planning and data interpretation. Sample collection in SRS must be consistent and unbiased over time, within each sampling episode, across sampling strata, and among LTRMP field stations. The partitioning of effort among strata within each SRS episode (Table B-1) reflects an emphasis on off-channel areas and a recognition that these areas are probably more spatially variable than the main channel.

During 1993–96, the Bellevue Field Station participated in 14 stratified random sampling episodes. In these 14 episodes, the field team visited about 2,100 sites (Appendix B) and about 2,000 grab samples were collected for chemical analyses. Most samples were analyzed for chlorophyll *a* and suspended solids, but in accord with the design for stratified random sampling, about half of the samples (1,100) were also analyzed for nitrogen and phosphorus species.

The total number of sites sampled in each episode and stratum is relatively uniform across the period of record (Table B-2), although there have been a few exceptions resulting from hazardous weather and unsafe ice conditions that prohibited safe field operations.

The SRS by the Bellevue field team has conformed well to the general LTRMP design, has been generally consistent during this period, and is centered on noon (Figure D-5). However, there is a tendency to sample the backwater and impounded strata later in the day in winter months; also, a shift toward earlier sampling times occurred in the main channel stratum in 1996.

Stratified Random Sampling Data

The SRS provides an unbiased estimate of conditions within each sampling stratum during each of four quarterly episodes per year. Seasonality, interannual variations, and long-term trends within each stratum can be assessed with summaries of these data (Appendix F); however, some of the most valuable applications for these data require analyses that are beyond the scope of this report. For example, the SRS provides statistically valid estimates of the extent or frequency of limnological conditions in combination (e.g., to meet the temperature, dissolved oxygen, and velocity requirements of overwintering fish); this information is being used to address changing relations among limnological variables over time, differences among the sampling strata, and habitat availability and suitability in the Upper Mississippi River ecosystem (Fischer et al. 1997; Soballe et al. 1997).

As with the fixed-site data, the SRS results (Appendix F) indicated a general decline in nitrogen and phosphorus concentrations from 1993 to 1996, and strong seasonality was noted in many of the parameters monitored. Winter is typified by a high Secchi transparency, high ammonium nitrogen, low total suspended solids, low volatile suspended solids, and low chlorophyll. Spring is characterized by high turbidity, high suspended solids, high chlorophyll levels, and relatively high plant nutrients. The summer sampling episodes have the lowest dissolved oxygen values recorded. Dissolved oxygen concentration is driven by the decreased solubility of oxygen in water at higher temperature. Dissolved oxygen values rarely fell below 5 mg/L (an accepted threshold for stress to many fish species). Extremely low oxygen values were found only in backwater areas. In fall, most of the monitored parameters were close to their annual averages.

As was found in the fixed-site sampling, ammonium nitrogen values peaked in winter beneath the ice. This was especially pronounced in winter 1996. These high under-ice ammonium values may add additional stress to fish populations, especially in backwaters. Fish are known to concentrate in certain backwaters and constant exposure to high ammonium may be detrimental. Further investigation of this phenomenon seems warranted.

Summary and Recommendations

In this report, we document 4 years of LTRMP sampling by the staff of the Iowa Department of Natural Resources, Mississippi River Monitoring Station at Bellevue, Iowa. The sampling crews completed about 1,900 visits to fixed sampling sites and 2,100 visits to stratified random sites from 1993 through 1996. We provide basic graphic and tabular summaries of the collected data.

The period of monitoring was marked by several important events: the redesign of the monitoring network and updating of field equipment in 1993, and record flooding in spring and summer 1993 and spring 1996. The zebra mussel, a prolific bivalve introduced from Europe that became well established in this study reach during this period, has the potential to affect water quality and river biota. When present in large numbers, zebra mussels can effectively filter a significant fraction of the plankton and other particulate material from the water, thus reducing turbidity and competing with other particulate feeders. By removing oxygen-producing phytoplankton from the water, by consuming oxygen in their own respiration, and by the decay of their fecal material, zebra mussels may significantly alter the oxygen regime. These effects can only be shown by continued, close-interval monitoring in vulnerable areas.

The monitoring data show that the Mississippi River near Bellevue is moderately turbid, has near-saturated dissolved oxygen concentrations at most locations throughout most of the year (near midday), and has high concentrations of plant nutrients (particularly nitrogen) and suspended sediment. Tributaries monitored in this study reach are especially rich in plant nutrients and suspended solids in relation to the main channel.

Several short-term trends were noted during this reporting period (1993–96). Plant nutrients (nitrogen and phosphorus) exhibited declining concentrations, as did turbidity, total suspended solids, volatile suspended solids, and chlorophyll *a*. One notable exception was ammonium nitrogen, which tended to increase and may have negative environmental effects if this trend continues.

We recommend future expansion of tributary monitoring in this reach because the watershed adjacent to Pools 12–14 is a major contributor of suspended solids and plant nutrients to the Mississippi River. Several tributaries in this reach remain unmonitored, including the Little Maquoketa River (Iowa), Catfish Creek (Iowa), the Little Menominee River (Illinois), Sisinawa River (Illinois), Tetes Des Morts River (Iowa), Mill Creek (Iowa), Apple River (Illinois), Elk River (Iowa), and Otter Creek (Illinois).

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Appendix A. Fixed-site Sampling Sites: January 1993–December 1996

In Appendix A, we provide information on the sample collection sites used from January 1993 through December 1996. In some instances, sites not used during this period have been included for reference. The site description tables provide additional information on the locations and are keyed to the site map. The site lists are provided in three formats to allow easy cross referencing: (1) by map identifier (north–south, then east–west), (2) in alphabetical order, and (3) by habitat class. The period of record for each site is also portrayed graphically (Figure A-5) so that the duration of and interruptions in the record can be easily visualized.

Location codes (seven characters) used for routine fixed-site sampling are based on the distance upstream from the river mouth or major confluence (river miles and tenths) and on the relative left-to-right (facing upstream) location of the site between the horizontal limits of the geological–historical floodplain. Sites on the Mississippi and Illinois River main stems use a single-letter prefix (M or I, respectively), whereas tributaries and Missouri River sites use a two-letter prefix (Table A-5). The left-to-right location of a site is indicated by a suffix between A and Z. When tributary sites are sampled in midstream, they are assigned the suffix M without regard to position in the floodplain. Locations near the left or right bank (facing upstream) are indicated with an A or Z, respectively.

Habitat classes (Table A-4) are assigned to all Long Term Resource Monitoring Program sampling locations used in fixed-site monitoring. Although these classes convey significant information about the site, the fixed sites are subjectively chosen and cannot be assumed to represent the associated habitat classes (see stratified random sampling, Appendix B).

Table A-1. Long Term Resource Monitoring Program fixed-site water quality sampling locations keyed to map codes with associated period of record from 1993 through 1996, habitat class, Universal Transverse Mercator (UTM) Coordinates (zone 15, meters), and the number of sampling visits to the site.

Location code	Map identification	Period of record	Habitat class[a]	UTM		Site visits 1993–1996
				Easting	Northing	
M582.5B	1	05/06/93–12/31/96	MC	693483	4711424	94
M574.2D	2	05/06/93–11/28/95	SC	698355	4701302	55
M566.2R	3	01/13/94–02/20/95	BWC	708476	4695192	8
M564.5T	4	01/13/94–01/25/96	BWC	710457	4693461	12
M563.9T	5	05/06/93–12/17/96	BWC	711179	4692608	90
TM04.1M	6	11/07/97–	TRIB	703023	4692249	0
M556.4A	7	10/15/90–12/17/96	MC	712792	4681148	112
M554.8F	8	08/02/88–11/17/94	MC	714669	4679382	37
M551.3N	9	08/02/88–10/21/96	BWC	719457	4676895	61
M551.3M	10	08/02/88–04/28/93	BWC	719234	4676806	17
M550.5L	11	08/02/88–04/28/93	MC	719815	4675321	16
AL02.3M	12	05/03/93–12/31/96	TRIB	728236	4674110	95
MQ02.1M	13	05/05/93–12/31/96	TRIB	720150	4671205	95
RC01.7M	14	05/03/93–12/31/96	TRIB	732728	4671124	95
M544.6F	15	01/13/89–04/27/93	BWC	727542	4670419	15
M545.5B	16	09/14/89–12/19/96	BWC	726287	4670292	109
M544.6E	17	06/19/95–10/09/95	BWC	727301	4670292	7
M543.6G	18	05/31/90–10/09/95	BWC	728972	4670128	7
M544.2D	19	08/05/88–04/27/93	BWC	728068	4669884	17
M544.2C	20	08/05/88–04/27/93	BWC	728063	4669840	17
M542.5E	21	08/09/88–04/27/93	BWC	729999	4669388	17
M542.7C	22	12/30/88–04/06/93	BWC	729830	4669270	4
M541.7L	23	06/19/95–10/09/95	BWC	731882	4668876	7
M540.2T	24	05/07/91–12/20/96	BWC	733781	4668352	110
M536.4B	25	08/10/88–04/07/93	BWI	732416	4662625	4
M535.9J	26	08/04/88–04/27/93	BWC	733189	4662145	17
M535.9K	27	08/04/88–04/27/93	BWC	733511	4662054	17
PR03.2M	28	05/03/93–12/31/96	TRIB	737936	4661849	95
M532.3T	29	05/07/91–12/20/96	BWC	737891	4656988	109
M530.3K	30	08/05/88–04/26/93	MC	736622	4653780	15
M529.7M	31	08/04/88–04/26/93	MC	737208	4652779	15
M525.5N	32	09/09/88–04/26/93	IMP	736505	4647293	16

Table A-1. Continued.

Location code	Map identification	Period of record	Habitat class[a]	UTM Easting	UTM Northing	Site visits 1993–1996
M525.5L	33	08/09/88–12/20/96	IMP	735860	4646700	108
RK03.7M	34	06/11/96–12/30/96	TRIB	723012	4630693	15
RK00.1M	35	06/11/96–12/30/96	TRIB	725147	4628644	15
M511.4B	36	05/05/93–12/30/96	MC	728010	4628642	95
M508.1F	37	05/05/93–12/30/96	BWC	723381	4625871	93
WP02.6M	38	05/05/93–12/30/96	TRIB	719436	4622793	95
M497.2B	39	05/19/93–12/30/96	MC	721528	4608462	94

[a]See Table A-4 for habitat class descriptions.

Table A-2. Long Term Resource Monitoring Program fixed-site water quality sampling sites sorted by location code with associated period of record from 1993 through 1996, habitat class, Universal Transverse Mercator (UTM) Coordinates (zone 15, meters), and number of sampling visits to the site.

Location code	Map identification	Period of record	Habitat class[a]	UTM Easting	UTM Northing	Site visits 1993–1996
AL02.3M	12	05/03/93–12/31/96	TRIB	728236	4674110	95
M497.2B	39	05/19/93–12/30/96	MC	721528	4608462	94
M508.1F	37	05/05/93–12/30/96	BWC	723381	4625871	93
M511.4B	36	05/05/93–12/30/96	MC	728010	4628642	95
M525.5L	33	08/09/88–12/20/96	IMP	735860	4646700	108
M525.5N	32	09/09/88–04/26/93	IMP	736505	4647293	16
M529.7M	31	08/04/88–04/26/93	MC	737208	4652779	15
M530.3K	30	08/05/88–04/26/93	MC	736622	4653780	15
M532.3T	29	05/07/91–12/20/96	BWC	737891	4656988	109
M535.9J	26	08/04/88–04/27/93	BWC	733189	4662145	17
M535.9K	27	08/04/88–04/27/93	BWC	733511	4662054	17
M536.4B	25	08/10/88–04/07/93	BWI	732416	4662625	4
M540.2T	24	05/07/91–12/20/96	BWC	733781	4668352	110
M541.7L	23	06/19/95–10/09/95	BWC	731882	4668876	7
M542.5E	21	08/09/88–04/27/93	BWC	729999	4669388	17
M542.7C	22	12/30/88–04/06/93	BWC	729830	4669270	4
M543.6G	18	05/31/90–10/09/95	BWC	728972	4670128	7
M544.2C	20	08/05/88–04/27/93	BWC	728063	4669840	17
M544.2D	19	08/05/88–04/27/93	BWC	728068	4669884	17
M544.6E	17	06/19/95–10/09/95	BWC	727301	4670292	7

Table A-2. Continued

Location code	Map identification	Period of record	Habitat class[a]	UTM		Site visits 1993–1996
				Easting	Northing	
M544.6F	15	01/13/89–04/27/93	BWC	727542	4670419	15
M545.5B	16	09/14/89–12/19/96	BWC	726287	4670292	109
M550.5L	11	08/02/88–04/28/93	MC	719815	4675321	16
M551.3M	10	08/02/88–04/28/93	BWC	719234	4676806	17
M551.3N	9	08/02/88–10/21/96	BWC	719457	4676895	61
M554.8F	8	08/02/88–11/17/94	MC	714669	4679382	37
M556.4A	7	10/15/90–12/17/96	MC	712792	4681148	112
M563.9T	5	05/06/93–12/17/96	BWC	711179	4692608	90
M564.5T	4	01/13/94–01/25/96	BWC	710457	4693461	12
M566.2R	3	01/13/94–02/20/95	BWC	708476	4695192	8
M574.2D	2	05/06/93–11/28/95	SC	698355	4701302	55
M582.5B	1	05/06/93–12/31/96	MC	693483	4711424	94
MQ02.1M	13	05/05/93–12/31/96	TRIB	720150	4671205	95
PR03.2M	28	05/03/93–12/31/96	TRIB	737936	4661849	95
RC01.7M	14	05/03/93–12/31/96	TRIB	732728	4671124	95
RK00.1M	35	06/11/96–12/30/96	TRIB	725147	4628644	15
RK03.7M	34	06/11/96–12/30/96	TRIB	723012	4630693	15
TM04.1M	6	11/07/97–	TRIB	703023	4692249	0
WP02.6M	38	05/05/93–12/30/96	TRIB	719436	4622793	95

[a]See Table A-4 for habitat class descriptions.

Table A-3. Long Term Resource Monitoring Program fixed-site water quality sampling locations sorted by habitat class with associated period of record from 1993 through 1996, habitat class, Universal Transverse Mercator (UTM) Coordinates (zone 15, meters), and number of sampling visits to the site.

Location code	Map identification	Period of record	Habitat class[a]	UTM		Site visits 1993–1996
				Easting	Northing	
M508.1F	37	05/05/93–12/30/96	BWC	723381	4625871	93
M532.3T	29	05/07/91–12/20/96	BWC	737891	4656988	109
M535.9J	26	08/04/88–04/27/93	BWC	733189	4662145	17
M535.9K	27	08/04/88–04/27/93	BWC	733511	4662054	17
M540.2T	24	05/07/91–12/20/96	BWC	733781	4668352	110
M541.7L	23	06/19/95–10/09/95	BWC	731882	4668876	7
M542.5E	21	08/09/88–04/27/93	BWC	729999	4669388	17

Table A-3. Continued

Location code	Map identification	Period of record	Habitat class[a]	UTM		Site visits 1993–1996
				Easting	Northing	
M542.7C	22	12/30/88–04/06/93	BWC	729830	4669270	4
M543.6G	18	05/31/90–10/09/95	BWC	728972	4670128	7
M544.2C	20	08/05/88–04/27/93	BWC	728063	4669840	17
M544.2D	19	08/05/88–04/27/93	BWC	728068	4669884	17
M544.6E	17	06/19/95–10/09/95	BWC	727301	4670292	7
M544.6F	15	01/13/89–04/27/93	BWC	727542	4670419	15
M545.5B	16	09/14/89–12/19/96	BWC	726287	4670292	109
M551.3M	10	08/02/88–04/28/93	BWC	719234	4676806	17
M551.3N	9	08/02/88–10/21/96	BWC	719457	4676895	61
M563.9T	5	05/06/93–12/17/96	BWC	711179	4692608	90
M564.5T	4	01/13/94–01/25/96	BWC	710457	4693461	12
M566.2R	3	01/13/94–02/20/95	BWC	708476	4695192	8
M536.4B	25	08/10/88–04/07/93	BWI	732416	4662625	4
M525.5L	33	08/09/88–12/20/96	IMP	735860	4646700	108
M525.5N	32	09/09/88–04/26/93	IMP	736505	4647293	16
M497.2B	39	05/19/93–12/30/96	MC	721528	4608462	94
M511.4B	36	05/05/93–12/30/96	MC	728010	4628642	95
M529.7M	31	08/04/88–04/26/93	MC	737208	4652779	15
M530.3K	30	08/05/88–04/26/93	MC	736622	4653780	15
M550.5L	11	08/02/88–04/28/93	MC	719815	4675321	16
M554.8F	8	08/02/88–11/17/94	MC	714669	4679382	37
M556.4A	7	10/15/90–12/17/96	MC	712792	4681148	112
M582.5B	1	05/06/93–12/31/96	MC	693483	4711424	94
M574.2D	2	05/06/93–11/28/95	SC	698355	4701302	55
AL02.3M	12	05/03/93–12/31/96	TRIB	728236	4674110	95
MQ02.1M	13	05/05/93–12/31/96	TRIB	720150	4671205	95
PR03.2M	28	05/03/93–12/31/96	TRIB	737936	4661849	95
RC01.7M	14	05/03/93–12/31/96	TRIB	732728	4671124	95
RK00.1M	35	06/11/96–12/30/96	TRIB	725147	4628644	15
RK03.7M	34	06/11/96–12/30/96	TRIB	723012	4630693	15
TM04.1M	6	11/07/97–	TRIB	703023	4692249	0
WP02.6M	38	05/05/93–12/30/96	TRIB	719436	4622793	95

[a]See Table A-4 for habitat class descriptions.

Table A-4. Habitat classes used in fixed-site water quality sampling. Previous habitat classes refer to categories used from 1988 through 1993 and are now combined within each of the present habitat classes.

Present habitat class designator	Previous habitat designators included in present class	Habitat class description
BWC	BWC, BWC-O, BWC-V	Contiguous backwaters
BWI	BWI, BWI-O, BWI-V	Isolated backwaters
SC	SC, SCB, SCT, SCU	Side channels
IMP	IMP-O, IMP-V	Impounded areas
IMP-L	IMP-L	Lakes—Swan or Pepin
MC	MC, CTR, CBU, CBW, TW, TWB, TWBU, TWR-O, TWW	Main channel
TRIB	TRIB, TRM	Tributary

Table A-5. Abbreviations used to designate fixed-site sampling locations in the Long Term Resource Monitoring Program (LTRMP). Not all streams in this list have been sampled by the LTRMP. The Mackinaw, Spoon, and Sangamon Rivers are all tributaries to the Illinois River. Each site identifier includes the distance (in miles) above the tributary mouth (xx.x) and the relative location (A–Z) of the sampling site between the left and right (facing upstream) limits of the floodplain.

Site identifier	Tributary name
APxx.xM	Apple River, Missouri
ALxx.xM	Apple River, Illinois
BCxx.xM	Bob's Creek, Missouri
BFxx.xM	Buffalo River, Wisconsin
BKxx.xM	Black River, Wisconsin
BMxx.xM	Big Muddy River, Illinois
BXxx.xM	Bad Axe River, Wisconsin
CAxx.xM	Cahokia Creek, Illinois
CCxx.xM	Coon Creek, Wisconsin
CFxx.xM	Catfish Creek, Iowa
CHxx.xM	Chippewa River, Wisconsin
CNxx.xM	Cannon River, Minnesota
CRxx.xM	Cache River, Illinois
CUxx.xM	Cuivre River, Missouri
DCxx.xM	Dardenne Creek, Missouri
DMxx.xM	Des Moines River, Iowa
ERxx.xM	Elk River, Iowa
HDxx.xM	Headwaters Diversion, Missouri (formerly Little River, LRxx.xM)
Ixxx.xZ	Illinois River, Illinois

Table A-5. Continued

Site identifier	Tributary name
IWxx.xM	Iowa River, Iowa
LMxx.xM	LaMoines River, Illinois
LRxx.xM	Little River, Missouri (now Headwaters Diversion, HDxx.xM)
LXxx.xM	La Crosse River, Wisconsin
Mxxx.xZ	Mississippi River (main stem)
MCxx.xM	Mill Creek, Iowa
MKxx.xM	Mackinaw River, Illinois
MOxx.xM	Missouri River, Missouri
MQxx.xM	Maquoketa River, Iowa
PExx.xM	Peruque Creek, Missouri
PIxx.xM	Piasa Creek, Illinois
PRxx.xM	Plum River, Illinois
QVxx.xM	Quiver Creek, Illinois
Rxxx.xM	Root River, Minnesota
RCxx.xM	Rush Creek, Illinois
Sxxx.xM	Spoon River, Illinois
SGxx.xM	Sangamon River, Illinois
SKxx.xM	Skunk River, Iowa
SXxx.xM	St. Croix River, Minnesota/Wisconsin
UIxx.xM	Upper Iowa River, Iowa
VMxx.xM	Vermillion River, Minnesota
WDxx.xM	Wood River, Illinois
WPxx.xM	Wapsipinicon River, Iowa
WSxx.xM	Wisconsin River, Wisconsin
WWxx.xM	Whitewater River, Minnesota
YLxx.xM	Yellow River, Iowa
ZMxx.xM	Zumbro River, Minnesota

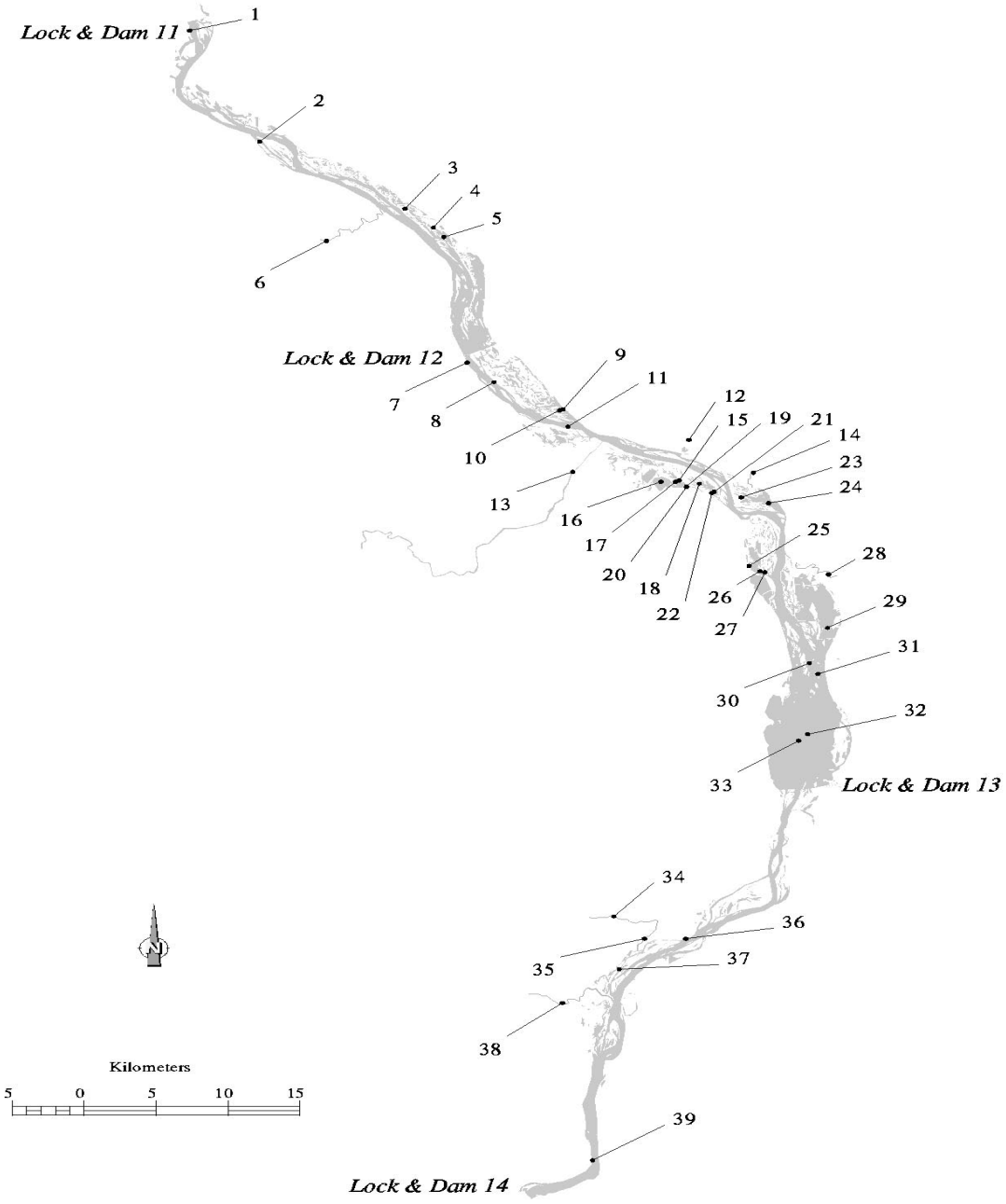

Figure A-1. Fixed-site sampling locations in the Bellevue study area.

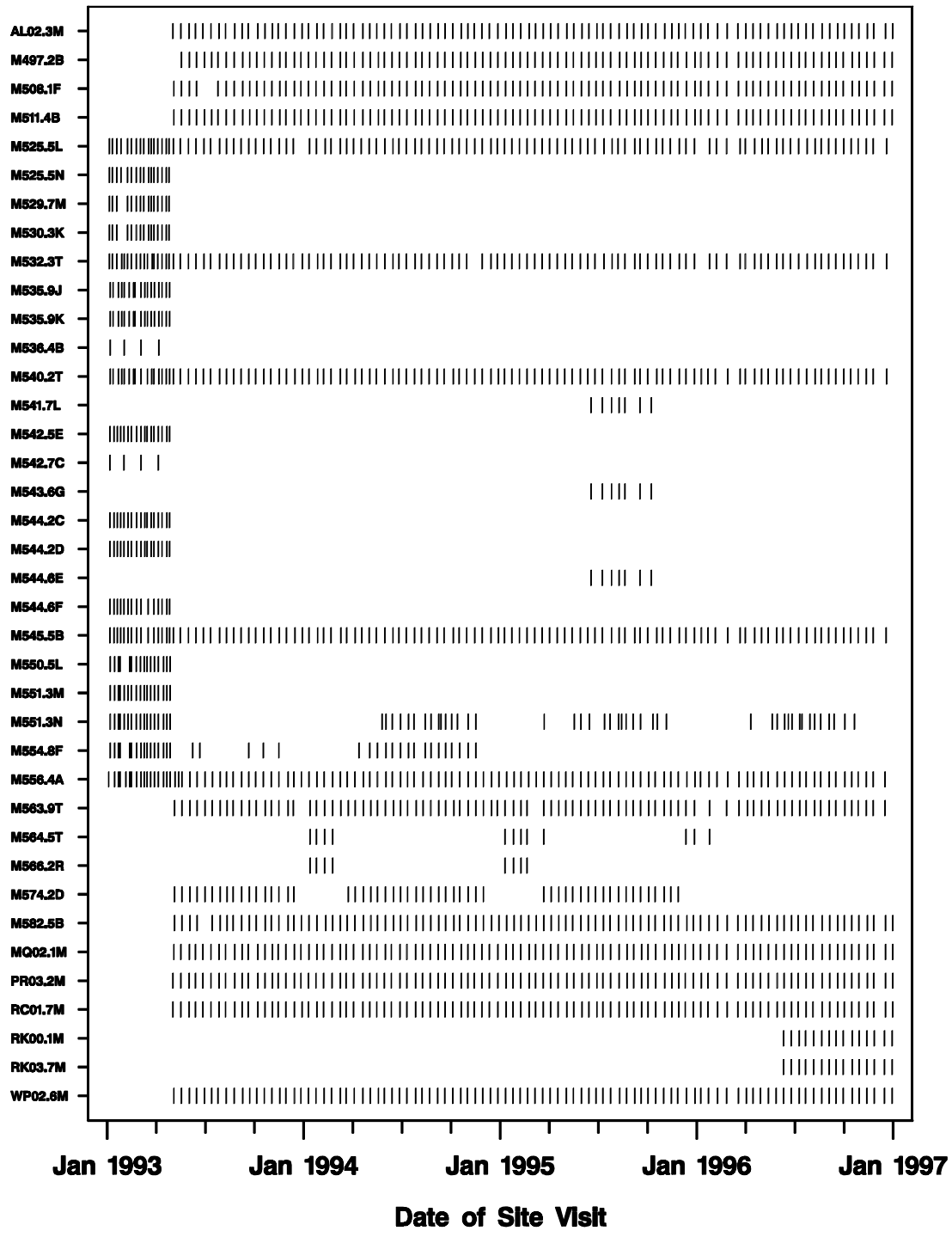

Figure A-2. Sampling dates from January 1993 through December 1996 at each of the fixed sites monitored by the Bellevue Field Station.

Appendix B. Stratified Random Sampling Sites: January 1993–December 1996

Randomly selected sites are used in stratified random sampling (SRS) to provide an unbiased representation of sampling strata (and entire study areas) within each Long Term Resource Monitoring Program study reach. Individual sites are generally not resampled in subsequent SRS episodes. Information from an individual site is not intended to be interpreted in isolation, as it is only a single random measurement from all the locations within a stratum during a specific episode. When pooled together, multiple measurements (sites) from each stratum provide a statistically reliable sample of the episode and the study reach.

Unlike the fixed-site location maps (Appendix A), the maps provided for SRS do not show the individual sampling locations, but rather the sampling strata within the reach. This approach allows a legible portrayal and deemphasizes the individual identities of SRS locations.

The tables in Appendix B show the allocation of sampling effort across the sampling strata and across the 14 SRS episodes within the 1993–96 period.

Table B-1. Sampling strata and design allocation of sampling effort for water quality stratified random sampling in the vicinity of the Bellevue Field Station. Total area of the study reach is greater than the total area included within the sampling strata due to inaccessible areas that are excluded from sampling.

Sampling stratum	Area within the stratum (ha)	Fraction of study area within the stratum (%)	Number of potential sampling sites in the stratum[a]	Number of sites assigned	Fraction of stratum sampled (%)	Fraction of total effort (%)
Main channel	2,700	24	675	30	4.4	20
Side channel	805	7	3,219	30	0.9	20
Backwater	2,811	25	11,242	60	0.5	40
Lake	–	–	–	–	–	–
Impounded	3,560	32	890	30	3.4	20
Isolated	116	1	29	0	0.0	0
Total[b]	11,183	89	16,055	150	9.3	100

[a]Total potential sites reflect a 200-m grid in most strata but a 50-m grid in side channels and backwaters.
[b]Total area refers to the entire pool or study reach and is greater than the sum of areas within the sampling strata.

Table B-2. Sampling dates and sampling activity of the Bellevue Field Station in each stratified random sampling episode from 1993 through 1996.

Sampling period			Number of samples collected/sites visited						
	Date			Main	Side	Contiguous			
Episode	Start	End	Total	channel	channel	backwater	Lake	Impoundment	Isolated
Summer 93	08/02/93	08/05/93	151/151	30/30	30/30	61/61	NA	30/30	NA
Fall 93	10/11/93	10/18/93	155/154	30/30	30/30	63/62	NA	32/32	NA
Winter 94	01/31/94	02/10/94	121/121	16/16	30/30	59/59	NA	16/16	NA
Spring 94	04/25/94	05/02/94	150/150	30/30	30/30	60/60	NA	30/30	NA
Summer 94	07/25/94	08/05/94	153/153	30/30	30/30	62/62	NA	31/31	NA
Fall 94	10/03/94	10/14/94	156/156	30/30	32/32	64/64	NA	30/30	NA
Winter 95	01/30/95	02/06/95	150/150	30/30	30/30	60/60	NA	30/30	NA
Spring 95	04/24/95	05/02/95	153/153	30/30	30/30	62/62	NA	31/31	NA
Summer 95	07/26/95	08/04/95	154/154	30/30	30/30	63/63	NA	31/31	NA
Fall 95	10/18/95	10/26/95	152/152	30/30	30/30	62/62	NA	30/30	NA
Winter 96	01/30/96	02/12/96	136/136	16/16	30/30	60/60	NA	30/30	NA
Spring 96	04/22/96	05/02/96	150/150	30/30	30/30	60/60	NA	30/30	NA
Summer 96	07/24/96	07/31/96	154/154	30/30	30/30	64/64	NA	30/30	NA
Fall 96	10/07/96	10/15/96	164/164	30/30	32/32	70/70	NA	32/32	NA

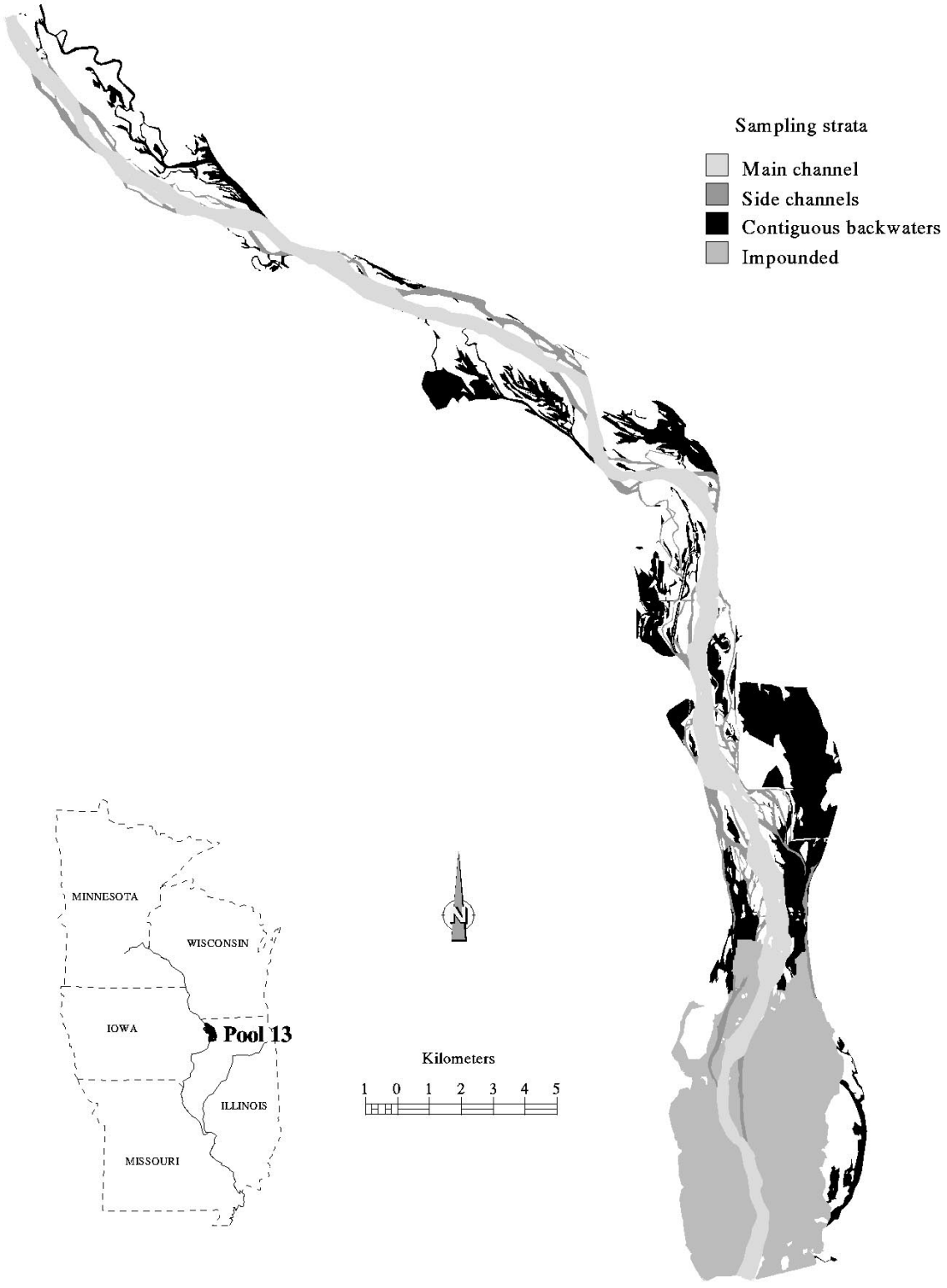

Figure B-1. Long Term Resource Monitoring Program sampling strata used in water quality stratified random sampling in the vicinity of the Bellevue Field Station.

Appendix C. Limnological Parameters Measured in the Long Term Resource Monitoring Program

Table C-1. Period of record for limnological measurements (laboratory and in situ) performed by Long Term Resource Monitoring Program field teams from 1988 through 1996.

Parameter	1988	1989	1990	1991	1992	1993–1996
Water temperature	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Dissolved oxygen	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Conductivity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
pH				June [redacted]	[redacted]	[redacted]
Turbidity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Secchi depth	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total suspended solids				[redacted]	[redacted]	[redacted]
Volatile suspended solids				[redacted]	[redacted]	[redacted]
Chlorophyll *a*				June [redacted]	[redacted]	[redacted]
Total phosphorus				June [redacted]	[redacted]	[redacted]
Soluble reactive phosphorus				June [redacted]	[redacted]	[redacted]
Total soluble phosphorus				June [redacted]	[redacted]	[redacted] Apr 93
Total nitrogen				June [redacted]	[redacted]	[redacted]
Total soluble nitrogen				June [redacted]	[redacted]	[redacted] Apr 93
NO_x (nitrate–nitrite)				June [redacted]	[redacted]	[redacted]
NH_x (ammonium)				June [redacted]	[redacted]	[redacted]
Si (silicate)				June [redacted]	[redacted]	[redacted]
Cl (chloride)				June [redacted]	[redacted]	[redacted]
Ca (calcium)				June [redacted]	[redacted]	[redacted]
Mg (magnesium)				June [redacted]	[redacted]	[redacted]
Na (sodium)				June [redacted]	[redacted]	[redacted]
K (potassium)				June [redacted]	[redacted]	[redacted]
Fe (iron)				June [redacted]	[redacted]	[redacted] Feb 93
Mn (manganese)				June [redacted]	[redacted]	[redacted] Feb 93
Ice and snow	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Water depth	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Water velocity	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table C-2. Laboratory measurements performed on limnological samples from 1988 through 1996. Each laboratory processed samples or parameters between the dates listed. The precision of result reporting is shown in parentheses. Analytical techniques are described in the procedures manuals for the Waterways Experiment Station (WES) Environmental Laboratories and by the American Public Health Association et al. (1992).

	Laboratory		
Parameter and method	**WES–Vicksburg**	**WES–Eau Galle**	**UMESC[a]**
Total suspended solids: Gravimetric/105° C	—	June 91–June 93 (1 µg/L)	June 93–Present (1 µg/L)
Volatile suspended solids: Gravimetric/550° C	—	June 91–June 93 (1 µg/L)	June 93–Present (1 µg/L)
Chlorophyll *a*: Fluorometric-DMSO-acetone extraction	—	—	June 93–Present (1 µg/L)
Chlorophyll *a*: Spectrophotometric 90% acetone extraction	—	June 91–June 93 (1 µg/L)	June 93–Present (1 µg/L)
Total phosphorus: Automated/persulfate/ ascorbic acid	—	June 91–Jan. 94 (1 µg/L)	Jan. 94–Present (1 µg/L)
Soluble reactive phosphorus (H): Automated/ H_2SO_4 preservation, ascorbic acid	June 91–Dec 93 (1 µg/L)	—	—
Soluble reactive phosphorus: Automated/ frozen/ascorbic acid	Jan. 94–Feb. 94 (1 µg/L)	—	Feb. 94–Present (1 µg/L)
Total soluble phosphorus: Automated/persulfate/ascorbic acid	—	June 91–Apr. 93 (1 µg/L)	—
Total nitrogen: Automated/Devarda's alloy	—	June 91–Jan. 94 (0.01 mg/L)	Jan. 94–Present (0.01 mg/L)
Total soluble nitrogen: Automated/Devarda's alloy	—	June 91–Apr. 93 (0.01 mg/L)	--
Nitrate–nitrite nitrogen: Automated Cd reduction, ion chromatography	June 91–Apr. 94 Automated Cd reduction (0.01 mg/L)	—	Apr–June 94: Cd reduction June 94–Present: Ion C. (0.01 mg/L)
NH_x: Automated salicylate	June 91–Feb. 94 (1 µg/L)	—	Feb. 94–Present (1 µg/L)
Dissolved silicate silica: Automated/molybdate	June 91–Feb. 94 (0.01 mg/L)	—	Mar. 94–Present (0.01 mg/L)
SO_4: Ion chromatography	—	—	Jan. 94–Present (0.1 mg/L)
Dissolved chloride: Automated ferro-cyanide, ion chromatography	June 91–June 94: Automated FeCN (0.1 mg/L)	—	June 94–Present: IC (0.1 mg/L)
Dissolved calcium: Ion chromatography	—	—	Jan. 94–Present (0.1 mg/L)

Table C-2. Continued

Parameter and method	Laboratory		
	WES–Vicksburg	WES–Eau Galle	UMESC[a]
Dissolved calcium: Atomic absorption	June 91–Oct. 93 (0.1 mg/L)	—	Oct. 93–Jan. 94 (0.1 mg/L)
Dissolved magnesium: Ion chromatography			Jan 94–Present (0.1 mg/L)
Dissolved sodium: Ion chromatography			Jan. 94–Present (0.1 mg/L)
Dissolved potassium: Atomic absorption	June 91–Oct. 93 (0.1 mg/L)	—	Oct. 93–Present (0.1 mg/L)
Dissolved iron: Atomic absorption	June 91–Apr. 93 (0.01 mg/L)	—	—
Dissolved manganese: Atomic absorption	June 91–Apr. 93 (0.01 mg/L)	—	—

[a]Upper Midwest Environmental Sciences Center

Appendix D. Water Quality Sample Collection

Details of sample collection are important to ensure that field activities comply with the monitoring design and are producing unbiased results. The figures in Appendix D focus on site visits and sample collection times. Consistent differences in sampling times among sites, over time, or among field stations can introduce serious bias into measurements influenced by daily cycles (e.g., temperature and dissolved oxygen). Gaps in the data record can also have important ramifications for data interpretation and are therefore documented here.

Table D-1. Fixed-site sampling visit exceptions from 1993 through 1996 at the Bellevue Field Station. Table entries are keyed to numbered points on Figure D-1.

Figure code	Date	Site visits	Comment
1	05/10/93	1	One fixed site from previous week sampled on 5/14/93
2	06/07/93	1	Zebra mussel (*Dreissena polymorph*a) monitoring site sampled 6/9/93
3	06/21/93	1	Zebra mussel monitoring site sampled 6/22/93
4	04/11/94	1	Zebra mussel monitoring site sampled 4/14/94
5	05/23/94	1	Zebra mussel monitoring site sampled 5/27/94
6	08/15/94	2	Zebra mussel monitoring site sampled 8/15/94
7	09/12/94	1	Zebra mussel monitoring site sampled 9/13/94
8	10/10/94	1	Zebra mussel monitoring site sampled 10/14/94
9	06/19/95	3	Zebra mussel monitoring site sampled 6/19/95
10	08/14/95	1	Zebra mussel monitoring site sampled 08/15/95
11	10/09/95	4	Zebra mussel monitoring sites sampled this week
12	11/06/95	1	Zebra mussel monitoring site sampled 11/6/95
13	02/19/96	0	Hovercraft breakdown
14	03/11/96	0	Unsafe ice and delay to return to schedule
15	04/08/96	1	Zebra mussel monitoring site sampled 4/11/96
16	05/20/96	1	Zebra mussel monitoring site sampled 5/21/96
17	06/17/96	1	Zebra mussel monitoring site sampled 6/20/96
18	07/15/96	1	Zebra mussel monitoring site sampled 7/15/96
19	07/29/96	1	Zebra mussel monitoring site sampled 7/30/96
20	09/09/96	1	Zebra mussel monitoring site sampled 9/13/96
21	10/21/96	1	Zebra mussel monitoring site sampled 10/21/96
22	12/09/96	0	Two weeks between samples

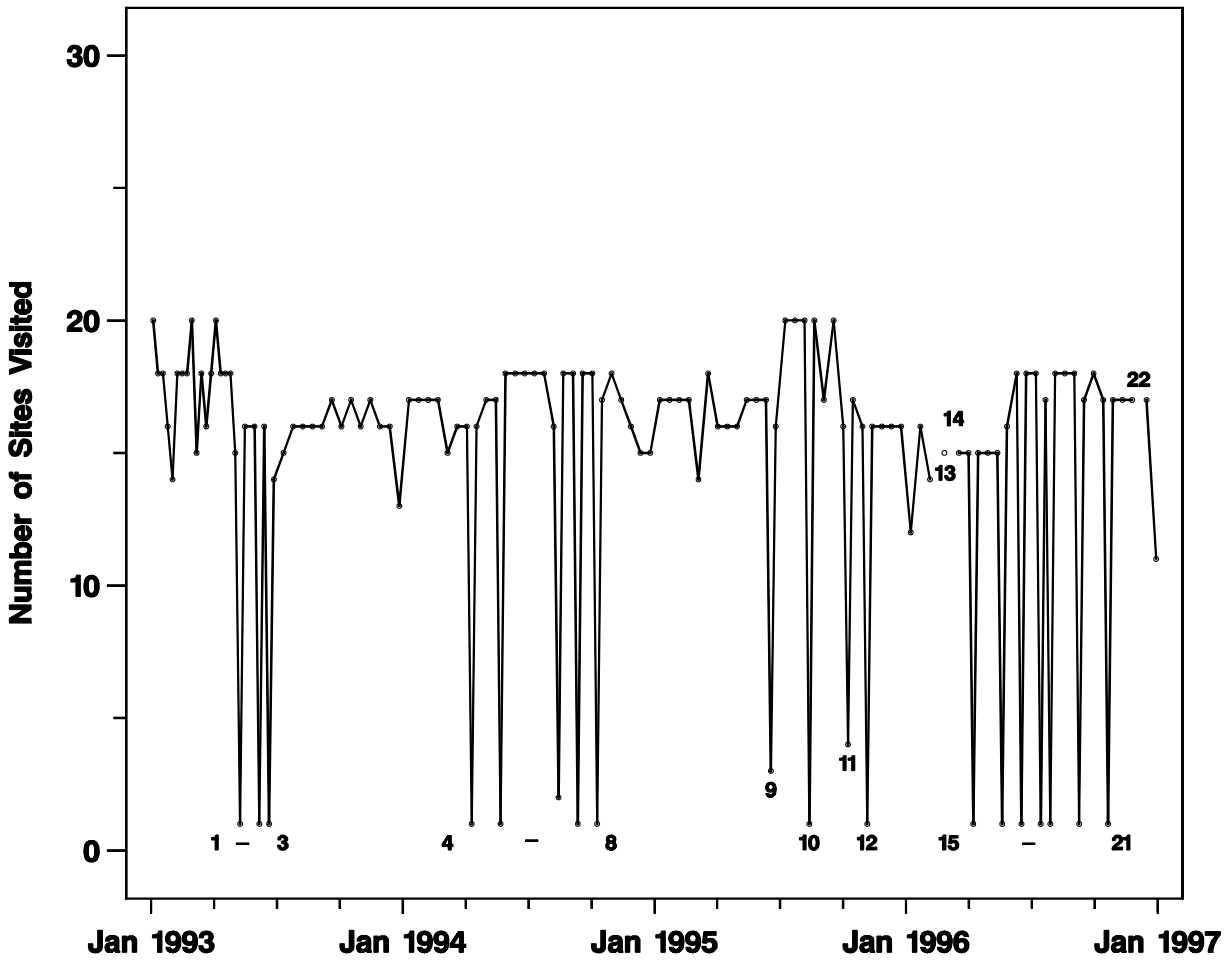

Figure D-1. Number of weekly fixed-site visits from January 1993 through December 1996 by the Bellevue Field Station. Numbered points are weeks that differ by more than one standard deviation from the mean site visits per week and are described in Table D-1.

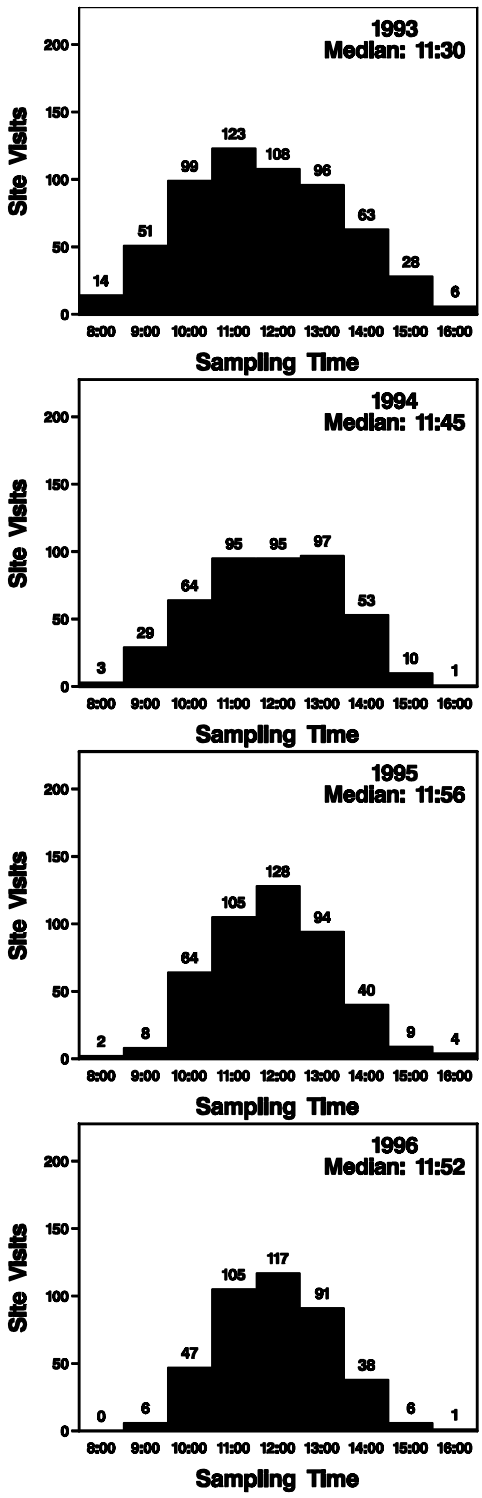

Figure D-2. Distribution of sample collection times at fixed sites from 1993 through 1996. Each bar is labeled with the number of site visits within each hourly interval.

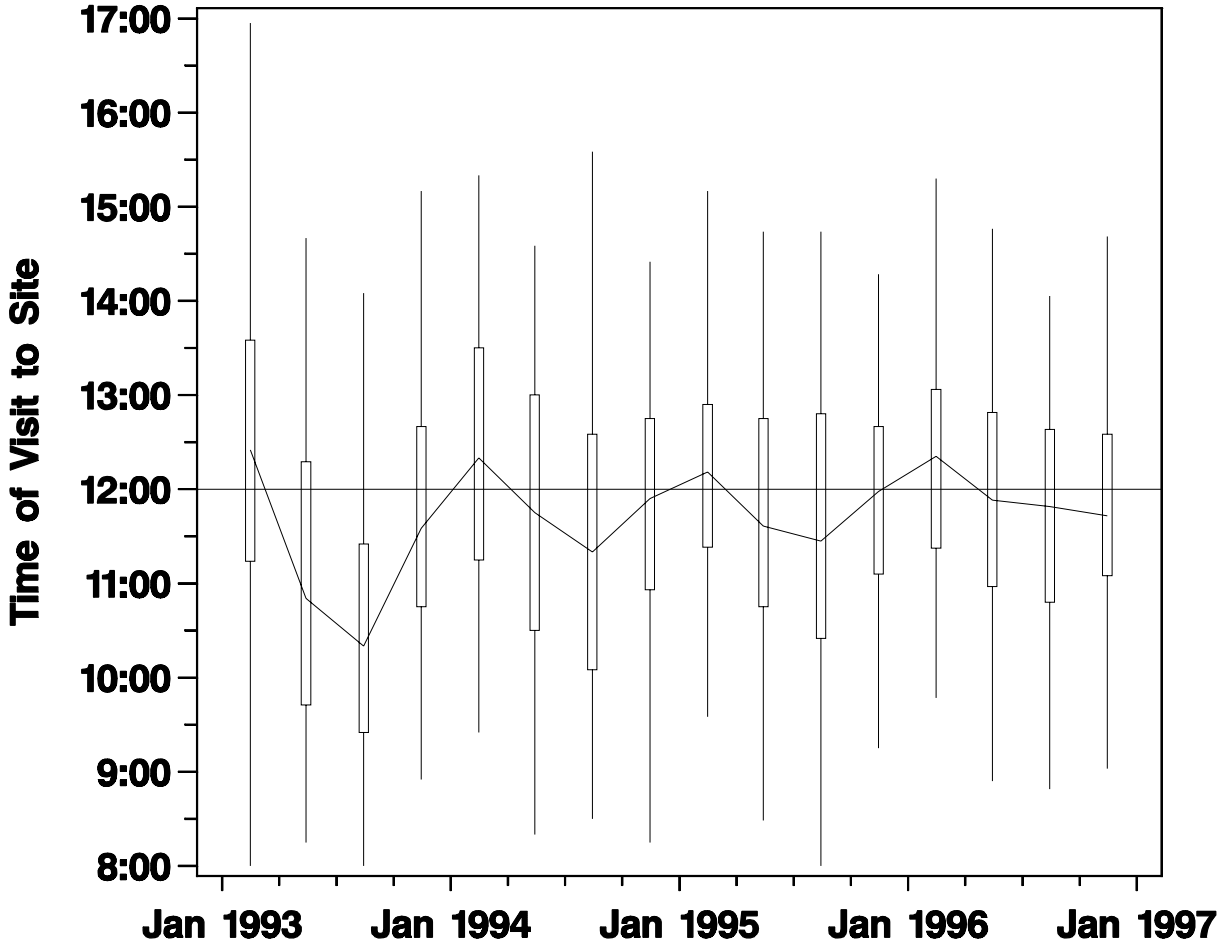

Figure D-3. Trend in fixed-site sample collection times by quarter, from 1993 through 1996. The midpoint (median) for each quarter is joined by a solid line. The box extending above and below the median denotes the 90th and 10th percentiles, respectively. The vertical line extends above and below the box to the maximum and minimum values for the quarter.

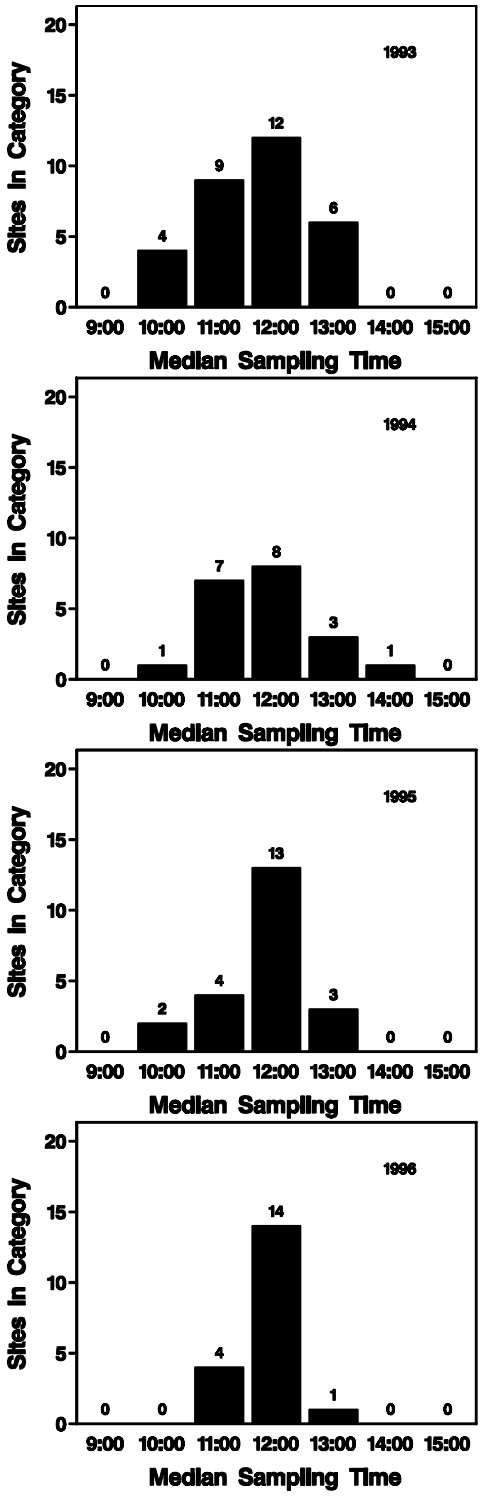

Figure D-4. Distribution of fixed sites by median sampling time at each site from 1993 through 1996.

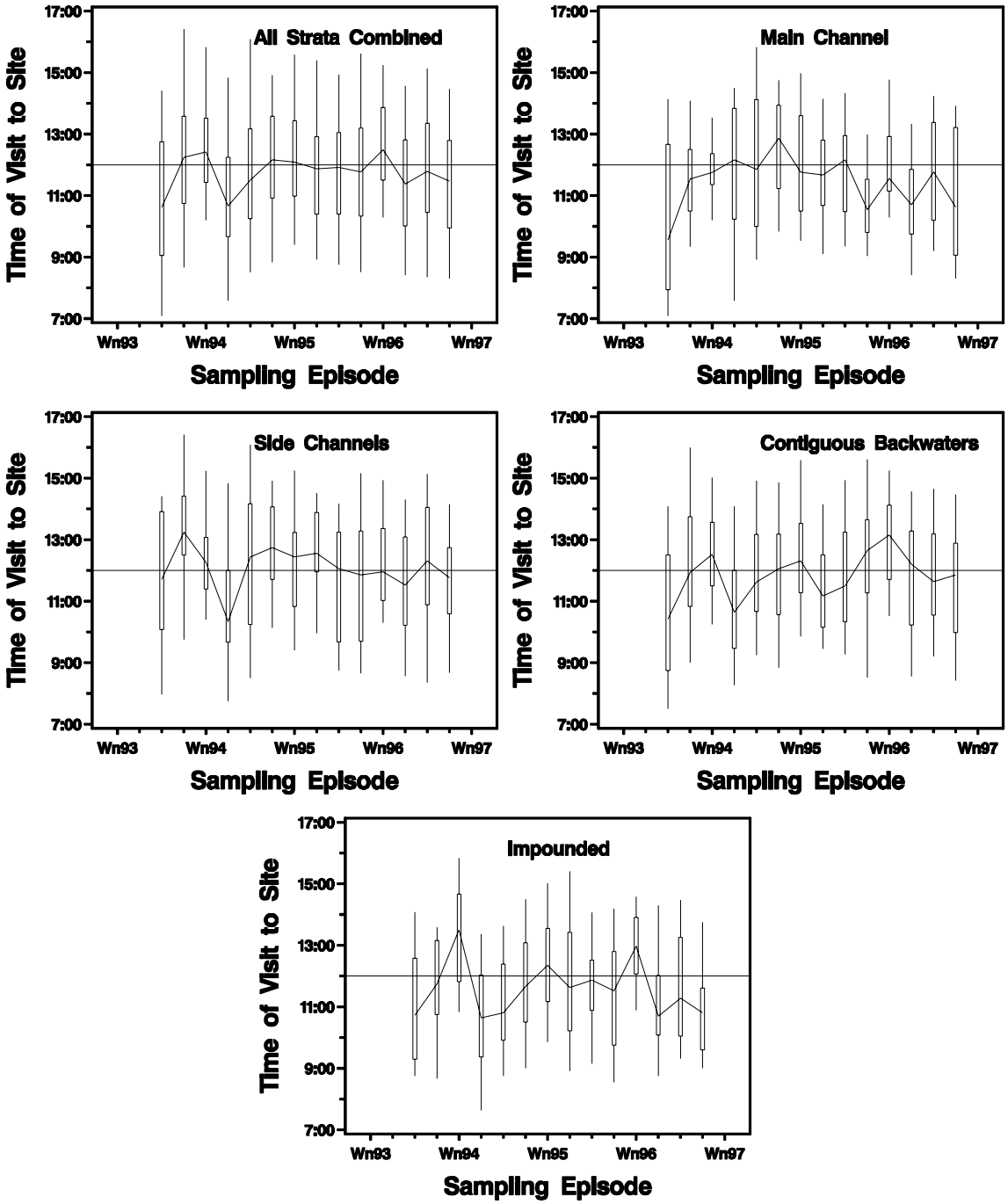

Figure D-5. Water quality sample collection times in each sampling stratum during each episode of stratified random sampling from 1993 through 1996. The midpoints (median) of the episodes are joined by a solid line. The box extending above and below the median denotes the 90th and 10th percentiles, respectively. The vertical line extends above and below each box to the maximum and minimum values for the episode.

Appendix E. Fixed-site Sampling Data: January 1993–December 1996

In Appendix E, we summarize the fixed-site monitoring data in both tabular and graphic forms. The tables contain annual statistics for each fixed site divided into two parameter groups: (1) physical and biological measurements (Table E-1), and (2) chemical data (major anions, cations, and plant nutrients; Table E-2). Within each parameter group, the data are divided by sampling depth into three groups (surface, middepth, and bottom). Chemical measurements are typically collected only at the surface and near the bottom. The majority of all measurement are in the near-surface category. Refer to Appendix A for descriptions and locations of the individual sampling sites. Sites with less than five visits during the 1993–96 period are excluded from these summaries.

The figures (E-1 and E-2) of the fixed-site data are in two formats. For sampling on the Mississippi (or Illinois) River main stems, the figures generally include separate plots of monthly means from main channel and impounded sites near the upstream and downstream ends of the reach or pool (where available). For tributary sampling, only a single plot is provided. Unlike the summary tables, these figures combine data from all sampling depths.

Data that have been flagged as questionable in the Long Term Resource Monitoring Program database are excluded from this summary. Values that are below detection are indicated by the detection limit preceded by a negative sign. Below-detection values are included in the determination of minima, maxima, and medians, but in the calculation of means and standard deviations, values below detection have been replaced by a value equal to half the detection limit. The Secchi transparency data in this report do not include observations where Secchi transparency exceeded the water column depth. High transparency conditions are thus underrepresented.

Table E-1. Annual summaries (1993–1996) of physical measurements at fixed sites grouped into four categories: near-surface (less than or equal to 0.2 m below the surface), middepth, near bottom (less than or equal to 0.2 m above the substrate), and miscellaneous depths.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1993 Near-surface measurements:																			
AL02.3M	Mean	0.2	4.02	—	100	8	20	0	14	9.16	86	613	8	32	122	35.2	7.2	—	—
	Median	0.2	3.93	—	100	8	20	0	15.3	8.55	86	634	8	32	31	33.3	6.9	—	—
	Minimum	0.2	2.8	—	100	8	20	0	0.1	6	73	402	7.3	32	6	5.8	0.6	—	—
	Maximum	0.2	6.5	—	100	8	20	0	25	13.2	100	767	8.8	32	1700	104	15.1	—	—
	Std. dev.	0	1.17	—	—	—	—	—	7.69	2.31	7.13	91.7	0.38	—	394	27.7	4.52	—	—
	N obs.	18	18	0	1	1	1	1	18	18	18	18	18	1	18	15	15	0	0
M497.2B	Mean	0.2	1.78	—	90	10	100	6	15.1	9.51	90	434	8	34.9	35	42.9	9.5	34.7	—
	Median	0.2	1.64	—	90	10	100	6	17.1	8.3	89	445	8	38	29	38.7	10.1	20.4	—
	Minimum	0.2	0.6	—	90	10	100	6	0	5.8	67	362	6.8	16	7	7.7	0.7	4.99	—
	Maximum	0.2	4.1	—	90	10	100	6	26.3	15.2	126	493	9.1	52	105	93.4	18.5	114	—
	Std. dev.	0	0.92	—	—	—	—	—	8.65	3.22	16.5	41.7	0.57	11.5	25.5	26	4.47	39.7	—
	N obs.	17	15	0	1	1	1	1	17	17	17	17	17	13	17	14	14	14	0
M508.1F	Mean	0.2	1.74	0.06	100	12	95	2	14.7	11.8	110	488	8.3	42.1	23	30.2	10.1	70.7	—
	Median	0.2	1.85	0	100	12	95	2	16.4	9.85	116	496	8.3	46	19	22.4	9.6	56.9	—
	Minimum	0.2	0.5	0	100	12	95	2	0	5.6	64	312	6.9	28	10	11.1	1.7	8.42	—
	Maximum	0.2	3.4	0.48	100	12	95	2	28.8	20	152	660	9.2	50	42	75.7	22	164	—
	Std. dev.	0	0.85	0.13	—	—	—	—	8.82	4.87	27.9	79.2	0.56	8.74	9.87	18.1	5.38	57.3	—
	N obs.	16	16	15	1	1	1	1	16	16	16	16	16	15	16	13	13	13	0
M511.4B	Mean	0.2	1.85	—	75	10	25	0	15.4	9.43	90	433	8.1	35.1	37	49.9	9.6	30.6	—
	Median	0.2	1.9	—	75	10	25	0	17	8.4	87	432	8.1	32	31	42.3	9.7	13.6	—
	Minimum	0.2	0.6	—	75	10	25	0	0	5.3	62	290	7.3	16	6	7.1	0.5	1.87	—
	Maximum	0.2	4	—	75	10	25	0	27.8	15	138	521	9.2	80	110	141	21.3	154	—
	Std. dev.	0	1.06	—	—	—	—	—	8.39	3.31	18.7	48.5	0.51	15	26.8	41	5.24	44.6	—
	N obs.	18	16	0	1	1	1	1	18	18	18	17	17	15	18	14	14	15	0
M525.5L	Mean	0.2	1.51	0.26	98.8	24	48	2	9.15	11.3	94	409	8.2	40.9	36	41.2	9.9	33.6	—
	Median	0.2	1.3	0.26	100	26	45	0	6.1	11.5	93	400	8.1	38.5	27	37.3	8.9	19.6	—
	Minimum	0.2	0.88	0.1	95	18	0	0	0	5.7	66	255	7	12	4	3.2	0.7	3.74	—
	Maximum	0.2	3.7	0.5	100	30	100	7	25	15.8	148	553	9.2	90	164	93.9	41.7	145	—
	Std. dev.	0	0.63	0.12	2.31	4.07	45.7	2.7	9.38	3.12	15.4	61.9	0.57	21.9	34.4	28.1	8.92	42.7	—
	N obs.	33	33	22	8	8	8	8	33	32	32	33	32	28	33	18	18	14	0
M525.5N	Mean	0.2	1.07	0.15	98.8	24	48	2	2.24	13.1	95	412	8.4	31.4	36	37.5	6.6	13.1	—
	Median	0.2	0.97	0.1	100	24	45	0	0.15	13.4	98	404	8.3	27	24	15.2	5.4	11.3	—
	Minimum	0.2	0.74	0.06	95	21	0	0	0	10.3	73	324	7.5	16	4	2.3	2.3	1.78	—
	Maximum	0.2	1.98	0.36	100	28	100	6	11.2	15.8	108	542	9.1	58	85	117	13.5	28.1	—
	Std. dev.	0	0.37	0.11	2.31	2.83	45.7	2.4	3.43	1.71	7.88	72.2	0.5	14.5	31.7	54	4.88	11	—
	N obs.	16	16	16	8	8	8	8	16	15	15	16	16	10	16	4	4	4	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1993 Near-surface measurements:																			
M529.7M	Mean	0.2	1.62	0.22	99.3	23	53	2	2.31	12.8	93	408	8.3	53.5	40	57.5	7.6	14.1	—
	Median	0.2	1.63	0.16	100	23	50	1	0.1	13.1	93	418	8.2	40	32	39.6	6	14.3	—
	Minimum	0.2	1.5	0.07	95	14	0	0	0	9.8	68	308	7.3	15	4	3.7	2.8	1.34	—
	Maximum	0.2	1.8	0.45	100	29	100	6	11.3	15.8	108	535	9.2	120	112	147	15.5	26.7	—
	Std. dev.	0	0.12	0.12	1.89	5.34	47.2	2.8	3.56	1.83	9.56	75.5	0.5	38.7	37.6	67.3	5.76	10.5	—
	N obs.	15	15	15	7	7	7	7	15	14	14	15	15	15	15	4	4	4	0
M530.3K	Mean	0.2	2.72	0.77	97.1	16	50	1	2.19	12.7	92	416	8.3	54.6	49	—	—	—	—
	Median	0.2	2.57	0.67	100	18	50	0	0.1	12.9	93	410	8.4	38	33	—	—	—	—
	Minimum	0.2	2.14	0.31	90	10	0	0	0	9.4	66	319	7.4	13	4	—	—	—	—
	Maximum	0.2	3.98	1.49	100	28	100	6	11	15.8	108	550	9	160	160	—	—	—	—
	Std. dev.	0	0.49	0.41	3.93	6.78	44.3	2.5	3.45	1.9	10.1	76.6	0.41	45.2	46.7	—	—	—	—
	N obs.	15	15	15	7	7	7	7	15	14	14	15	15	15	15	0	0	0	0
M532.3T	Mean	0.2	1.5	0.05	97.5	17	31	1	9.89	12.7	107	400	8.5	48.6	23	24.2	7.6	32.8	—
	Median	0.2	1.3	0	100	20	5	0	6.8	13	102	394	8.5	46	16	22.5	7.2	15.7	—
	Minimum	0.2	0.96	0	80	1	0	0	0	5.3	63	256	7.2	15	4	2.7	1.2	4.68	—
	Maximum	0.2	3.7	0.3	100	26	100	3	27	20	195	563	9.8	92	166	52.3	16.3	118	—
	Std. dev.	0	0.64	0.08	6.22	7.3	41.9	1.2	8.99	4.32	26.6	77.4	0.72	19	29	13	4.02	36.2	—
	N obs.	35	35	35	12	12	12	12	35	32	32	35	34	30	35	19	19	15	0
M535.9J	Mean	0.2	1.49	0.09	97.5	21	35	1	2.41	12.1	88	439	8.2	47.3	26	16.3	4.5	—	—
	Median	0.2	1.21	0.02	100	24	3	0	0.4	12.3	89	454	8.1	42	16	14.6	4.2	—	—
	Minimum	0.2	0.94	0	80	7	0	0	0	9.7	67	303	7.8	16	5	5	3.6	—	—
	Maximum	0.2	3.2	0.42	100	28	100	7	11.1	14.6	100	571	9	98	84	31	5.9	—	—
	Std. dev.	0	0.67	0.14	6.22	7.12	48	2.1	3.57	1.45	7.83	84	0.32	26	25.2	13.1	1.02	—	—
	N obs.	17	17	17	12	12	12	12	17	16	16	17	17	12	17	4	4	0	0
M535.9K	Mean	0.2	1.9	0.09	100	31	42	1	2.49	12.4	91	427	8.3	60.5	20	—	—	—	—
	Median	0.2	1.56	0	100	31	0	0	0.7	12.8	90	427	8.2	52	10	—	—	—	—
	Minimum	0.2	1.44	0	100	14	0	0	0	8.9	61	236	7.5	18	6	—	—	—	—
	Maximum	0.2	3.56	0.52	100	38	100	9	11.1	15.6	107	550	9.2	100	72	—	—	—	—
	Std. dev.	0	0.64	0.19	0	6.41	48.5	2.7	3.43	1.79	10.5	83	0.44	27.8	18.6	—	—	—	—
	N obs.	17	17	17	13	13	13	13	17	15	15	17	17	17	17	0	0	0	0
M540.2T	Mean	0.2	1.86	0.17	99.2	25	26	1	9.39	11.4	96	425	8.1	40.8	26	31.6	7.8	24.9	—
	Median	0.2	1.33	0.04	100	28	0	0	6.2	11.8	92	426	8.1	34	24	36	7.6	13.5	—
	Minimum	0.2	1	0	90	3	0	0	0	5.4	64	217	7.3	10	5	4.4	0.6	1.78	—
	Maximum	0.2	4.3	0.76	100	33	100	9	26.8	20	156	615	9.4	110	79	65.3	18.2	123	—
	Std. dev.	0	0.9	0.22	2.77	8.4	37.5	2.6	9.5	3.5	19.5	90.3	0.49	21.5	17.4	19.6	4.07	32.2	—
	N obs.	34	34	34	13	13	13	13	34	33	33	34	33	29	33	19	19	19	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1993 Near-surface measurements:																			
M542.5E	Mean	0.2	1.92	0.07	98.5	30	41	2	2.56	12.5	91	439	8	53.4	25	14.4	4.5	—	—
	Median	0.2	1.49	0	100	32	10	0	0.9	12.4	90	396	8.1	52	13	14.1	4.4	—	—
	Minimum	0.2	1.29	0	80	16	0	0	0	10.4	81	288	5.6	16	4	3.8	3.8	—	—
	Maximum	0.2	3.8	0.59	100	37	100	9	11.5	17.2	119	584	8.9	100	86	25.7	5.4	—	—
	Std. dev.	0	0.83	0.18	5.55	5.93	46.3	3.3	3.48	1.68	8.49	99.1	0.74	27.3	24.6	11.5	0.82	—	—
	N obs.	17	17	17	13	13	13	13	17	17	17	17	17	17	17	4	4	0	0
M544.2C	Mean	0.2	3.14	0.04	100	17	41	1	3.14	11.1	83	449	8.2	58.8	21	23.2	6.4	17.2	—
	Median	0.2	2.67	0	100	18	60	0	1.2	12.2	91	490	8	67	11	13.3	5.4	17.5	—
	Minimum	0.2	2.4	0	100	12	0	0	0	2.3	16	300	7.5	16	6	6.9	4.7	9.36	—
	Maximum	0.2	5.3	0.21	100	20	100	6	12	16.4	116	565	9.5	92	82	59.2	10.3	24.6	—
	Std. dev.	0	0.98	0.07	0	2.78	38.9	2	3.64	3.74	28.7	84.9	0.54	26	21.6	24.4	2.6	6.23	—
	N obs.	17	17	17	9	9	9	9	17	16	16	17	17	17	17	4	4	4	0
M544.2D	Mean	0.2	1.35	0.03	92	21	38	2	3.24	11	84	449	8.1	39.2	21	—	—	—	—
	Median	0.2	0.88	0	100	22	35	0	1.3	11.9	91	460	8.1	32	12	—	—	—	—
	Minimum	0.2	0.6	0	20	2	0	0	0	2.8	19	312	7.5	18	5	—	—	—	—
	Maximum	0.2	3.2	0.26	100	28	100	8	12	18	156	568	9.2	68	64	—	—	—	—
	Std. dev.	0	0.87	0.07	25.3	6.94	39.2	2.8	3.78	3.89	32.6	86.4	0.44	19.8	18.9	—	—	—	—
	N obs.	17	17	17	10	10	10	10	17	16	16	17	17	9	17	0	0	0	0
M544.6F	Mean	0.2	3.74	0.02	100	18	41	0	3.93	9.02	69	454	8	61.4	20	—	—	—	—
	Median	0.2	3.24	0	100	18	50	0	2.9	10.3	81	434	7.8	57	12	—	—	—	—
	Minimum	0.2	2.99	0	100	10	0	0	0.4	2.8	20	310	7.4	18	6	—	—	—	—
	Maximum	0.2	5.58	0.15	100	24	90	2	11.8	16.4	122	556	9.5	124	75	—	—	—	—
	Std. dev.	0	0.94	0.05	0	4.16	40	.63	3.59	4.23	32.8	82	0.58	31	17.9	—	—	—	—
	N obs.	15	15	15	10	10	9	10	15	13	13	15	15	15	15	0	0	0	0
M545.5B	Mean	0.2	3.6	0.01	100	22	39	2	10.7	11.6	104	435	8.2	55.3	18	60.4	9	54	—
	Median	0.2	3.25	0	100	22	20	0	8.5	10.7	94	433	8.2	50	15	22.7	8.5	45.2	—
	Minimum	0.2	2.5	0	100	12	0	0	0	2.5	18	297	6.7	18	5	6.4	1.7	4.49	—
	Maximum	0.2	6.3	0.14	100	30	100	7	27.8	19.1	221	569	9.8	119	54	573	16.1	148	—
	Std. dev.	0	1.05	0.03	0	5.16	44.4	2.5	9.37	4.02	42	75	0.67	22.5	11.7	148	3.8	38.7	—
	N obs.	33	32	32	11	11	11	11	32	29	29	32	31	32	32	14	14	14	0
M550.5L	Mean	0.2	2.49	0.59	85	18	40	1	2.11	13	94	425	8.3	59.8	21	—	—	—	—
	Median	0.2	2.08	0.5	85	19	35	1	0	13.5	94	443	8.3	50	11	—	—	—	—
	Minimum	0.2	1.3	0.34	80	10	0	0	0	10.3	82	330	7.5	18	4	—	—	—	—
	Maximum	0.2	5.54	0.9	90	25	90	2	12	16	109	505	9.3	112	78	—	—	—	—
	Std. dev.	0	1.31	0.21	5.77	6.27	39.2	.96	3.63	1.69	6.88	60.7	0.49	30.8	20.7	—	—	—	—
	N obs.	16	16	16	4	4	4	4	16	16	16	16	16	13	16	0	0	0	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1993 Near-surface measurements:																			
M551.3M	Mean	0.2	2.14	0.07	100	36	44	1	2.29	13.1	94	413	8.4	58.3	13	—	—	—	—
	Median	0.2	1.58	0	100	38	30	0	0.5	13.6	95	445	8.3	49	13	—	—	—	—
	Minimum	0.2	1.29	0	100	20	0	0	0	9.1	63	299	7.3	28	3	—	—	—	—
	Maximum	0.2	4.3	0.35	100	42	100	9	12	17.6	122	525	10.3	114	31	—	—	—	—
	Std. dev.	0	1.02	0.13	0	5.85	47.4	2.6	3.46	2.11	11.6	81.3	0.64	26.1	8.91	—	—	—	—
	N obs.	17	17	17	13	13	13	13	17	16	16	17	17	12	17	0	0	0	0
M551.3N	Mean	0.2	4.14	0.24	100	15	35	1	2.19	12.7	92	419	8.2	77.2	13	15.1	4.7	13.9	—
	Median	0.2	3.63	0.06	100	15	10	0	0.2	12.9	92	454	8.2	90	7	11.9	4.6	14.2	—
	Minimum	0.2	2.95	0.03	100	2	0	0	0	9.9	68	306	7.5	26	5	4	3.7	2.67	—
	Maximum	0.2	6.5	0.88	100	20	100	10	12.3	15.7	108	504	9.1	116	46	32.8	5.7	24.5	—
	Std. dev.	0	1.11	0.33	0	5.35	43.3	3.1	3.66	1.58	7.98	73.8	0.39	30.7	10.8	13.8	1	8.92	—
	N obs.	17	17	17	10	10	10	10	17	17	17	17	17	17	17	4	4	4	0
M554.8F	Mean	0.2	2.09	0.31	98	16	42	1	5.27	12.3	95	415	8.2	51.4	21	38.8	5.9	12.4	—
	Median	0.2	1.8	0.26	100	15	20	0	0.4	13.2	93	425	8.2	42	16	27.9	5.6	14.6	—
	Minimum	0.2	1.1	0.11	90	10	0	0	0	6.1	71	320	6.9	22	4	3.9	3.8	2.23	—
	Maximum	0.2	4	0.67	100	20	100	5	22.5	15.8	140	506	9.5	100	64	95.6	8.6	18.2	—
	Std. dev.	0	0.91	0.18	4.47	4.04	49.2	2.2	7.13	2.54	13.5	64.5	0.57	22.1	17.2	43.9	2.41	7.02	—
	N obs.	21	21	19	5	5	5	5	21	20	20	21	21	16	21	4	4	4	0
M556.4A	Mean	0.2	2.16	0.24	33.3	4	20	0	8.79	11.3	94	431	8.1	50.3	22	36.3	8	23.8	—
	Median	0.2	1.58	0.22	30	5	10	0	5	11.7	93	436	8.1	45	22	33.4	8.6	15.7	—
	Minimum	0.2	0.9	0.02	20	2	0	0	0	5.3	61	325	7	16	4	4.6	0.5	4.99	—
	Maximum	0.2	5.5	0.51	50	5	50	0	25.1	16	119	535	9.4	126	82	96.4	14.7	115	—
	Std. dev.	0	1.12	0.17	15.3	1.73	26.5	0	9.33	2.83	11.5	52.3	0.51	26	18.4	25	4.09	28	—
	N obs.	36	36	18	3	3	3	3	36	35	35	36	36	28	36	15	15	15	0
M563.9T	Mean	0.2	1.14	0.06	95	3	0	0	15.6	10.4	99	413	8.1	42.6	27	36.5	8.8	27.7	—
	Median	0.2	0.9	0.04	95	3	0	0	16.5	8.6	98	429	8	35.5	31	43	10.1	16.3	—
	Minimum	0.2	0.4	0	90	2	0	0	0.6	5.3	61	247	6.9	22	6	6	0.4	5.24	—
	Maximum	0.2	3.7	0.31	100	3	0	0	25.8	20	156	520	9.2	100	40	63.5	14.8	115	—
	Std. dev.	0	0.87	0.08	7.07	0.71	0	0	8.52	4.4	27.4	57.7	0.62	22.6	11.4	17.8	3.96	34.5	—
	N obs.	17	17	17	2	2	2	2	17	17	17	17	17	16	17	14	14	14	0
M574.2D	Mean	0.2	2.74	0.66	—	—	—	—	15.1	9.72	92	420	8	49	28	42.9	8.3	28.2	—
	Median	0.2	2.74	0.66	—	—	—	—	15.8	9	91	420	7.9	40	26	38.1	9.1	16	—
	Minimum	0.2	0.6	0.66	—	—	—	—	0.7	5.7	66	333	6.8	24	7	6.5	0.4	3.74	—
	Maximum	0.2	5.5	0.66	—	—	—	—	24.7	15	136	486	9.2	110	84	91.4	16	143	—
	Std. dev.	0	1.36	—	—	—	—	—	8.13	3.2	17.3	39.3	0.59	26.6	18.6	27.3	4.71	38.3	—
	N obs.	17	17	1	0	0	0	0	17	17	17	17	17	17	17	14	14	14	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1993 Near-surface measurements:																			
M582.5B	Mean	0.2	3.77	—	100	10	10	0	13.6	10.3	94	443	8.1	54.7	26	40	10.2	30.6	—
	Median	0.2	3.4	—	100	10	10	0	15.5	10.3	96	449	7.9	40	25	32.7	9.3	14.6	—
	Minimum	0.2	1.4	—	100	10	10	0	0	5.9	68	374	6.9	22	4	4.9	0.3	3.74	—
	Maximum	0.2	6.1	—	100	10	10	0	24.7	15	136	495	9.1	125	55	91.9	35.8	145	—
	Std. dev.	0	1.46	—	—	—	—	—	8.71	3.1	15.1	31.1	0.58	33.3	14.8	29.7	8.83	44.8	—
	N obs.	17	17	0	1	1	1	1	17	17	17	17	17	17	17	14	14	14	0
MQ02.1M	Mean	0.2	1.77	—	80	6	90	0	14	9.34	88	554	7.9	—	221	95.6	11.9	—	—
	Median	0.2	1.3	—	80	6	90	0	14.9	9.15	90	578	8	—	36	57.7	10.3	—	—
	Minimum	0.2	0.6	—	80	6	90	0	0	5.6	63	275	6.9	—	3	2.4	-0.1	—	—
	Maximum	0.2	5.5	—	80	6	90	0	23.8	12.8	99	677	8.8	—	2560	261	30.1	—	—
	Std. dev.	0	1.31	—	—	—	—	—	7.55	2.16	9.01	106	0.49	—	598	83.9	8.81	—	—
	N obs.	18	18	0	1	1	1	1	18	18	18	18	18	0	18	15	15	0	0
PR03.2M	Mean	0.2	2.37	—	100	10	75	0	13.5	8.55	79	658	7.8	18	70	47.7	9.4	—	—
	Median	0.2	2.35	—	100	10	75	0	15.1	8.1	81	652	7.9	18	31	54.2	10.1	—	—
	Minimum	0.2	0.9	—	100	10	75	0	0	5.5	62	499	5.5	18	5	5	0.3	—	—
	Maximum	0.2	3.8	—	100	10	75	0	24	12.7	92	818	8.7	18	690	134	24.7	—	—
	Std. dev.	0	0.62	—	—	—	—	—	7.63	2.31	8.56	77.3	0.66	—	157	35.7	6.43	—	—
	N obs.	18	18	0	1	1	1	1	18	18	18	18	18	1	18	15	15	0	0
RC01.7M	Mean	0.2	0.86	—	—	—	—	—	13.1	9.5	88	652	8	15	75	49.7	7.8	—	—
	Median	0.2	0.6	—	—	—	—	—	14.5	9.1	88	677	8.1	15	23	29.2	5.7	—	—
	Minimum	0.2	0.3	—	—	—	—	—	0.2	6.9	76	485	7.3	15	7	8.2	0.4	—	—
	Maximum	0.2	2.6	—	—	—	—	—	23	13.2	106	795	8.7	15	860	245	26	—	—
	Std. dev.	0	0.67	—	—	—	—	—	7.25	2.05	6.84	71.5	0.37	—	198	62	6.49	—	—
	N obs.	18	18	0	0	0	0	0	18	18	18	17	18	1	18	15	15	0	0
WP02.6M	Mean	0.2	1.88	—	100	12	100	5	14.5	9.12	86	451	7.8	—	59	115	17.5	—	—
	Median	0.2	1.79	—	100	12	100	5	16.4	8.75	89	478	8	—	33	52.8	10.9	—	—
	Minimum	0.2	0.5	—	100	12	100	5	0	6.3	73	297	5.8	—	6	4.9	0.4	—	—
	Maximum	0.2	3.6	—	100	12	100	5	25.5	12.7	100	591	8.4	—	276	692	65.4	—	—
	Std. dev.	0	0.91	—	—	—	—	—	8.22	2.34	8.23	89.4	0.59	—	72.2	188	20.3	—	—
	N obs.	18	18	0	1	1	1	1	18	18	18	18	18	0	18	15	15	0	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1993 Middepth measurements:																			
M535.9K	Mean	1.08	1.55	0	—	—	—	—	0.93	12.7	89	—	—	—	—	—	—	—	—
	Median	1.05	1.55	0	—	—	—	—	1.15	13	90	—	—	—	—	—	—	—	—
	Minimum	1	1.44	0	—	—	—	—	0	8.7	60	—	—	—	—	—	—	—	—
	Maximum	1.3	1.77	0	—	—	—	—	1.8	14.8	106	—	—	—	—	—	—	—	—
	Std. dev.	0.1	0.1	0	—	—	—	—	0.67	2.06	15.6	—	—	—	—	—	—	—	—
	N obs.	8	8	5	—	—	—	—	8	8	8	0	0	—	0	0	0	0	0
M545.5B	Mean	1.91	3.87	—	—	—	—	—	18.7	7.52	82	—	—	—	—	—	—	—	—
	Median	1.8	3.7	—	—	—	—	—	20.5	7.45	81	—	—	—	—	—	—	—	—
	Minimum	1.5	2.92	—	—	—	—	—	7.8	3.1	36	—	—	—	—	—	—	—	—
	Maximum	2.3	4.57	—	—	—	—	—	24.7	11.1	123	—	—	—	—	—	—	—	—
	Std. dev.	0.32	0.62	—	—	—	—	—	5.75	3.19	32	—	—	—	—	—	—	—	—
	N obs.	7	7	0	—	—	—	—	7	6	6	0	0	—	0	0	0	0	0
1993 Near-bottom measurements:																			
M532.3T	Mean	1.36	1.57	0	—	—	—	—	11.9	10.6	96	342	8.9	—	18	—	—	—	—
	Median	1.4	1.58	0	—	—	—	—	9.1	10.3	94	339	8.8	—	20	—	—	—	—
	Minimum	0.9	1.06	0	—	—	—	—	0	6.5	67	279	8	—	13	—	—	—	—
	Maximum	2.2	2.4	0	—	—	—	—	22.8	15.2	132	419	9.9	—	21	—	—	—	—
	Std. dev.	0.36	0.36	0	—	—	—	—	7.75	2.75	18.6	52.6	0.73	—	2.88	—	—	—	—
	N obs.	11	11	9	—	—	—	—	11	10	10	7	7	—	7	0	0	0	0
M540.2T	Mean	2.21	2.43	0.16	—	—	—	—	12.1	10.2	93	403	8.5	—	33	—	—	—	—
	Median	2.3	2.52	0.13	—	—	—	—	7.8	10.6	93	403	8.5	—	33	—	—	—	—
	Minimum	1.1	1.28	0	—	—	—	—	5.4	6.6	76	338	8	—	24	—	—	—	—
	Maximum	3.2	3.4	0.43	—	—	—	—	22.2	12.8	103	468	9	—	42	—	—	—	—
	Std. dev.	0.66	0.67	0.17	—	—	—	—	7.01	2.04	8.68	91.9	0.74	—	12.7	—	—	—	—
	N obs.	7	7	5	—	—	—	—	7	7	7	2	2	—	2	0	0	0	0
M544.2C	Mean	2.73	3.02	0.01	—	—	—	—	2.83	9.97	74	369	8.5	—	32	—	—	—	—
	Median	2.3	2.63	0	—	—	—	—	2.2	10.5	84	385	8.4	—	26	—	—	—	—
	Minimum	2.1	2.4	0	—	—	—	—	0.3	2	14	307	7.9	—	12	—	—	—	—
	Maximum	5.1	5.3	0.13	—	—	—	—	7.7	14.6	104	395	9	—	49	—	—	—	—
	Std. dev.	0.9	0.86	0.04	—	—	—	—	2.3	3.91	28.9	36	0.46	—	16.2	—	—	—	—
	N obs.	16	16	13	—	—	—	—	15	15	15	5	5	—	5	0	0	0	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1993 Near-bottom measurements:																			
M544.6F	Mean	3.28	3.6	0	—	—	—	—	3.28	8.48	64	370	8.1	—	36	—	—	—	—
	Median	2.8	3.18	0	—	—	—	—	2.9	9	75	383	7.9	—	32	—	—	—	—
	Minimum	2.6	2.99	0	—	—	—	—	0.7	0.3	2	313	7.8	—	12	—	—	—	—
	Maximum	5.4	5.57	0.03	—	—	—	—	7.5	16.6	124	400	8.8	—	69	—	—	—	—
	Std. dev.	0.93	0.86	0.01	—	—	—	—	2.08	4.69	35.1	39.2	0.46	—	24.5	—	—	—	—
	N obs.	13	13	9	—	—	—	—	13	13	13	4	4	—	4	0	0	0	0
M545.5B	Mean	3.2	3.46	0	—	—	—	—	9.33	8.93	74	388	8.2	—	26	39.2	18.1	42.2	—
	Median	2.7	2.98	0	—	—	—	—	6	9	79	397	8.2	—	19	24.3	7.5	25.7	—
	Minimum	2.3	2.5	0	—	—	—	—	0.1	0.1	1	317	7.4	—	10	19.7	7.4	19.3	—
	Maximum	6.1	6.3	0.02	—	—	—	—	24	18.1	139	457	9.1	—	97	73.7	39.4	98.1	—
	Std. dev.	1	0.95	0	—	—	—	—	8.04	4.74	36.3	49	0.59	—	23.6	29.9	18.5	37.7	—
	N obs.	27	27	19	—	—	—	—	27	27	27	12	12	—	12	3	3	4	0
M551.3N	Mean	3.21	3.54	0.05	—	—	—	—	0.61	13.4	93	—	—	—	—	—	—	—	—
	Median	3.2	3.52	0.01	—	—	—	—	0.1	13.5	92	—	—	—	—	—	—	—	—
	Minimum	2.6	2.95	0	—	—	—	—	0	11.2	86	—	—	—	—	—	—	—	—
	Maximum	4.1	4.47	0.19	—	—	—	—	5.3	15.8	108	—	—	—	—	—	—	—	—
	Std. dev.	0.45	0.43	0.07	—	—	—	—	1.65	1.18	6.32	—	—	—	—	—	—	—	—
	N obs.	10	10	7	—	—	—	—	10	10	10	0	0	—	0	0	0	0	0
1994 Near-surface measurements:																			
AL02.3M	Mean	0.2	2.86	—	100	23	70	0	12.3	10.9	102	634	8.1	170	34	39.8	9	—	—
	Median	0.2	2.8	—	100	23	80	0	13.6	10.8	92	649	8	170	25	31.4	7.3	—	—
	Minimum	0.2	2.2	—	100	16	30	0	0	7.2	73	467	6.3	170	5	2.8	1.8	—	—
	Maximum	0.2	4.25	—	100	29	100	1	24.2	17	202	782	8.6	170	312	389	58.6	—	—
	Std. dev.	0	0.48	—	0	6.51	36.1	.58	9.12	2.27	27.3	67.6	0.43	—	57.8	72.4	10.7	—	—
	N obs.	26	26	0	3	3	3	3	26	26	26	26	26	1	26	26	26	0	0
M497.2B	Mean	0.2	1.1	—	23.3	14	67	0	13	10.3	94	416	8.1	44.5	29	40.5	9.8	37.1	—
	Median	0.2	1.04	—	20	16	90	0	14.4	10.3	91	416	8	42	26	38	9	21.3	—
	Minimum	0.2	0.4	—	10	5	10	0	0	4.6	56	315	7.2	13	3	0.3	2.3	1.5	—
	Maximum	0.2	2.4	—	40	22	100	1	25.5	18.8	186	555	9.3	125	120	112	23.4	176	—
	Std. dev.	0	0.4	—	15.3	8.62	49.3	.58	10	3.27	23.1	55.7	0.44	22.2	22.1	26.8	5.5	43.9	—
	N obs.	26	26	0	3	3	3	3	26	26	26	26	26	24	26	26	26	26	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1994 Near-surface measurements:																			
M508.1F	Mean	0.2	1.27	0.01	100	20	50	2	13.9	12.8	124	451	8.4	47.7	22	25.4	13.3	82.4	—
	Median	0.2	1.1	0	100	24	50	2	13.9	13.2	137	451	8.5	40	21	27	12.2	80.8	—
	Minimum	0.2	0.82	0	100	2	0	0	0.2	5.2	36	240	7.6	12	5	2.7	2.5	5.61	—
	Maximum	0.2	2.62	0.03	100	30	100	5	28	20	243	704	9.2	100	74	52.1	29.4	308	—
	Std. dev.	0	0.41	0.01	0	12.1	54.8	2.6	10.5	4.39	47.5	110	0.47	23.9	14.3	14.6	7.13	67	—
	N obs.	26	26	26	6	6	6	6	26	26	26	26	26	25	26	26	26	26	0
M511.4B	Mean	0.2	0.92	—	80	7	95	10	13.4	10.2	93	420	8.1	33.9	33	51.3	10.7	33.6	—
	Median	0.2	0.76	—	80	7	95	10	13.3	9.85	94	420	8	35	25	34.5	9	13.8	—
	Minimum	0.2	0.4	—	80	3	90	0	0	5.3	67	316	7.6	12	3	0.6	2.6	4.12	—
	Maximum	0.2	2.74	—	80	10	100	20	29	15.8	150	544	9.2	48	164	220	33	220	—
	Std. dev.	0	0.52	—	0	4.95	7.07	14	10.5	3.14	17.1	55.9	0.43	9.19	31.8	49.9	7.71	49.1	—
	N obs.	26	26	0	2	2	2	2	26	26	26	26	26	19	26	26	26	26	0
M525.5L	Mean	0.2	1.09	0.2	100	26	60	6	12.9	10.7	98	405	8.2	38.7	38	54.5	10.8	39	—
	Median	0.2	1.04	0.18	100	27	100	6	12	10.7	94	404	8.1	36	30	34.6	8.9	25.3	—
	Minimum	0.2	0.88	0.11	100	20	0	0	0	5.9	72	330	7.6	8	3	1.6	1.5	-1	—
	Maximum	0.2	1.68	0.42	100	30	100	16	26.8	16.2	141	508	9.2	95	188	316	39.6	217	—
	Std. dev.	0	0.19	0.07	0	3.78	54.8	6.6	9.83	2.81	16.9	51.1	0.42	18.7	36.8	63.1	8.13	48.6	—
	N obs.	26	25	18	5	5	5	5	25	25	25	25	25	23	25	25	25	25	0
M532.3T	Mean	0.2	1.11	0.11	98.3	23	67	4	12.9	11.2	102	425	8.3	34.4	35	38.8	11.5	45.4	—
	Median	0.2	1	0.08	100	22	100	3	13	10.6	98	425	8.2	31	30	33.5	11.5	33.7	—
	Minimum	0.2	0.9	0	90	7	0	0	0	4.6	60	300	7.2	9	3	1.7	1.7	2.49	—
	Maximum	0.2	1.7	0.9	100	45	100	12	28.3	19.4	142	600	9.3	82	124	111	26.2	222	—
	Std. dev.	0	0.22	0.18	4.08	14.4	51.6	4.6	10.1	3.72	26.4	71.7	0.53	15.7	27.4	28.4	7.22	54.7	—
	N obs.	25	25	24	6	6	6	6	25	25	25	25	25	21	25	25	25	25	0
M540.2T	Mean	0.2	1.24	0.04	100	32	57	3	12.9	10.8	99	421	8.2	34.9	33	34.7	9.9	37	—
	Median	0.2	1.12	0.02	100	30	100	2	13.1	10.4	97	425	8.1	32	31	35.6	9.1	24	—
	Minimum	0.2	0.8	0	100	11	0	0	0	5.3	65	311	7.6	10	3	2.1	1.7	1.87	—
	Maximum	0.2	2.55	0.33	100	76	100	11	29.7	16.7	159	550	9.5	76	132	144	26.6	235	—
	Std. dev.	0	0.41	0.07	0	21.8	53.5	4.1	10.4	2.92	21.6	59.1	0.44	14.1	26.8	27.6	5.72	48.9	—
	N obs.	27	27	27	7	7	7	7	27	27	27	27	27	24	27	27	27	27	0
M545.5B	Mean	0.2	2.84	0.01	100	26	57	3	13.7	11.9	113	410	8.4	53.2	23	24.8	11.3	46	—
	Median	0.2	2.74	0	100	32	100	2	14.5	11.2	117	410	8.5	44	20	22.2	10.9	48	—
	Minimum	0.2	2.13	0	100	8	0	0	0	5.2	41	295	7.2	17	3	2.1	1.7	1.87	—
	Maximum	0.2	3.96	0.06	100	42	100	9	30.2	20	168	552	9.4	140	84	92.5	26.8	97.3	—
	Std. dev.	0	0.5	0.02	0	13.7	53.5	3.5	10.3	3.74	34.4	69.6	0.56	27.6	19.8	19.5	6.06	27.2	—
	N obs.	26	26	26	7	7	7	7	26	26	26	26	26	26	26	26	26	26	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1994 Near-surface measurements:																			
M551.3N	Mean	0.2	3.33	0.17	—	—	—	—	20.6	8.35	92	420	8.1	28.6	45	—	—	—	—
	Median	0.2	3.35	0.15	—	—	—	—	22	8.2	89	426	8.1	27	46	—	—	—	—
	Minimum	0.2	2.44	0	—	—	—	—	6.9	6.6	77	369	7.8	20	21	—	—	—	—
	Maximum	0.2	4.27	0.31	—	—	—	—	28.5	10.8	124	471	8.8	50	67	—	—	—	—
	Std. dev.	0	0.51	0.09	—	—	—	—	6.28	1.48	15	27.5	0.29	9.08	12	—	—	—	—
	N obs.	15	15	14	0	0	0	0	15	15	15	15	15	15	15	0	0	0	0
M554.8F	Mean	0.2	2.86	0.42	—	—	—	—	18.5	9.31	97	406	8.2	30.8	43	—	—	—	—
	Median	0.2	2.74	0.4	—	—	—	—	20.6	8.25	92	414	8.1	29	45	—	—	—	—
	Minimum	0.2	1.92	0.28	—	—	—	—	6.9	6.4	75	285	7.8	22	20	—	—	—	—
	Maximum	0.2	4.57	0.76	—	—	—	—	25.8	17.4	153	474	9.2	48	61	—	—	—	—
	Std. dev.	0	0.68	0.11	—	—	—	—	6.07	2.88	21.1	47.4	0.37	8.64	14.1	—	—	—	—
	N obs.	16	16	16	0	0	0	0	16	16	16	16	16	16	16	0	0	0	0
M556.4A	Mean	0.2	1.37	—	96.7	18	100	5	12.2	10.7	96	414	8.2	43.4	24	35.2	8.2	36.4	—
	Median	0.2	1.3	—	100	22	100	2	12.5	10.6	93	410	8.2	41	24	38.1	8.3	27.8	—
	Minimum	0.2	0.4	—	90	8	100	2	0	6.6	79	301	7.4	22	3	1.9	1.6	1.12	—
	Maximum	0.2	3.07	—	100	25	100	12	25.8	15.8	149	530	9.2	92	46	74.6	15.6	175	—
	Std. dev.	0	0.61	—	5.77	9.07	0	5.8	9.84	2.77	15.6	47.7	0.41	16.3	12.3	19.9	3.75	40.8	—
	N obs.	26	26	0	3	3	3	3	26	26	26	26	26	22	26	26	26	26	0
M563.9T	Mean	0.2	0.7	0.03	98.3	22	67	5	13.8	10.5	100	415	8.2	30.9	35	41.1	11	43.4	—
	Median	0.2	0.61	0.01	100	22	100	7	13.2	9.8	96	405	8.1	28	36	44.6	10.5	31.8	—
	Minimum	0.1	0.3	0	90	10	0	0	0	1.7	12	268	7	16	4	3.6	1.9	1.5	—
	Maximum	0.2	1.85	0.19	100	36	100	9	31	19.2	183	558	9.7	80	85	102	25.9	222	—
	Std. dev.	0.02	0.32	0.04	4.08	9.52	51.6	4.1	10.4	3.88	32.9	68.3	0.63	13.5	22.3	27.6	6.82	47.7	—
	N obs.	26	24	24	6	6	6	6	25	25	25	25	24	21	25	25	25	25	0
M574.2D	Mean	0.2	2.58	0.4	—	—	—	—	16.7	9.78	98	404	8.3	40.8	28	40.7	9.8	50.9	—
	Median	0.2	2.68	0.37	—	—	—	—	18.1	9.6	96	399	8.2	40	28	40.2	10	40.4	—
	Minimum	0.2	1.5	0.32	—	—	—	—	1.4	6.6	79	320	7.8	30	17	15.8	4	12.7	—
	Maximum	0.2	3.66	0.5	—	—	—	—	27.8	15.4	146	479	9.2	56	46	66.5	16	207	—
	Std. dev.	0	0.51	0.09	—	—	—	—	7.71	2.4	15.3	40.9	0.4	7.67	7.68	12.6	3.2	47.8	—
	N obs.	19	19	3	0	0	0	0	19	19	19	19	19	18	19	19	19	19	0
M582.5B	Mean	0.2	2.16	—	96.3	26	95	6	12.2	10.8	97	421	8.2	55.4	23	32.5	8.3	38.3	—
	Median	0.2	2.08	—	97.5	25	100	4	12.5	10.6	92	416	8.2	42	25	31.6	8.6	28.7	—
	Minimum	0.2	0.5	—	90	20	80	0	0	6.7	75	329	7.3	28	3	2.3	1.8	1.12	—
	Maximum	0.2	4.57	—	100	34	100	18	27.3	16.8	157	540	9.3	160	40	80.5	16.5	203	—
	Std. dev.	0	0.92	—	4.79	6.32	10	8	9.9	2.74	18.4	51	0.42	36.5	10.5	19.1	3.95	44.4	—
	N obs.	26	26	0	4	4	4	4	26	26	26	26	26	25	26	26	26	26	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1994 Near-surface measurements:																			
MQ02.1M	Mean	0.2	0.87	—	100	41	93	2	12.4	10.6	99	575	8.1	—	45	78.7	11.9	—	—
	Median	0.2	0.71	—	100	46	90	0	13.3	11	100	579	8.1	—	30	60	9.3	—	—
	Minimum	0.2	0.48	—	100	28	90	0	0	6.8	46	354	7.3	—	5	8.1	2	—	—
	Maximum	0.2	3.1	—	100	48	100	6	25.8	13	146	667	8.7	—	196	227	30.4	—	—
	Std. dev.	0	0.55	—	0	11	5.77	3.5	8.96	1.64	19.4	67.4	0.34	—	45.9	62	8.04	—	—
	N obs.	26	26	0	3	3	3	3	26	26	26	26	26	0	26	26	26	0	0
PR03.2M	Mean	0.2	1.71	—	100	30	83	2	11.5	9.42	84	669	8	149	39	53.2	9.1	—	—
	Median	0.2	1.6	—	100	34	80	0	13	10.2	83	683	8	149	31	39.8	7.8	—	—
	Minimum	0.2	1.11	—	100	16	70	0	0	6.2	70	479	7.3	149	5	3.9	1.5	—	—
	Maximum	0.2	2.8	—	100	39	100	5	24	13	106	790	8.4	149	292	415	62.8	—	—
	Std. dev.	0	0.41	—	0	12.1	15.3	2.9	8.33	2.22	9.27	67.1	0.25	—	53.8	78.3	11.4	—	—
	N obs.	26	26	0	3	3	3	3	26	26	26	26	26	1	26	26	26	0	0
RC01.7M	Mean	0.2	0.54	—	—	—	—	—	11.1	10.3	91	668	8.1	—	46	67.4	11.5	—	—
	Median	0.2	0.5	—	—	—	—	—	11.8	10.3	89	691	8.1	—	23	29.5	6.3	—	—
	Minimum	0.2	0.2	—	—	—	—	—	0	7.2	70	483	7.6	—	5	3.4	1.4	—	—
	Maximum	0.2	1.2	—	—	—	—	—	25.1	13.4	104	777	8.5	—	530	793	122	—	—
	Std. dev.	0	0.21	—	—	—	—	—	8.08	1.99	8.86	67.7	0.23	—	100	151	23.1	—	—
	N obs.	26	26	0	0	0	0	0	26	26	26	26	26	0	26	26	26	0	0
WP02.6M	Mean	0.2	1	—	100	40	100	4	12.8	11.4	108	422	8.2	—	43	83.3	17.4	—	—
	Median	0.2	0.83	—	100	25	100	5	14.7	11.9	102	399	8.2	—	33	88.1	17.2	—	—
	Minimum	0.2	0.5	—	100	22	100	1	0	6.5	58	249	7.2	—	4	1.5	1.3	—	—
	Maximum	0.2	2.9	—	100	74	100	6	26.8	13.2	156	584	8.9	—	116	198	38.7	—	—
	Std. dev.	0	0.57	—	0	29.2	0	2.6	10	1.82	28.1	100	0.49	—	30.7	60.6	12.3	—	—
	N obs.	26	26	0	3	3	3	3	26	26	26	26	26	0	26	26	26	0	0
1994 Middepth measurements:																			
M545.5B	Mean	1.47	2.98	—	—	—	—	—	21.7	9.25	103	458	8.4	—	23	—	—	—	—
	Median	1.35	2.74	—	—	—	—	—	23.4	8.35	96	458	8.4	—	23	—	—	—	—
	Minimum	1	2.13	—	—	—	—	—	13.5	6.6	86	458	8.4	—	23	—	—	—	—
	Maximum	2	3.96	—	—	—	—	—	28.3	15.4	148	458	8.4	—	23	—	—	—	—
	Std. dev.	0.37	0.69	—	—	—	—	—	5.24	3.12	22.7	—	—	—	—	—	—	—	—
	N obs.	6	6	0	—	—	—	—	6	6	6	1	1	—	1	0	0	0	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1994 Near-bottom measurements:																			
M545.5B	Mean	2.67	2.88	0	—	—	—	—	14.1	8.72	80	416	8.4	—	28	33.9	12.1	39.5	—
	Median	2.5	2.74	0	—	—	—	—	16	8	81	424	8.5	—	25	34.8	10.7	45.7	—
	Minimum	1.9	2.13	0	—	—	—	—	0.6	0.8	6	302	7.3	—	16	21.4	7.6	9.73	—
	Maximum	3.8	3.96	0	—	—	—	—	27.2	19.4	144	531	9.4	—	47	45.5	21.5	51.6	—
	Std. dev.	0.55	0.54	0	—	—	—	—	9.05	4.71	33.8	57.4	0.47	—	8.34	9.92	5.36	15.6	—
	N obs.	22	22	16	—	—	—	—	22	22	22	18	18	—	14	6	6	6	0
1995 Near-surface measurements:																			
AL02.3M	Mean	0.2	2.82	—	98.3	10	23	0	11.5	11.3	102	639	8	—	31	34	6.7	20.6	—
	Median	0.2	2.72	—	100	11	0	0	11.7	10.9	92	661	8	—	20	20.4	5.5	10.7	—
	Minimum	0.2	1.8	—	90	1	0	0	0.1	6.6	75	485	7.6	—	5	4.3	2	-1	—
	Maximum	0.2	4	—	100	16	90	2	27.2	25	315	710	8.4	—	207	226	31.5	89.1	—
	Std. dev.	0	0.63	—	4.08	5.28	38.3	.82	9.9	3.79	45.4	55.8	0.19	—	42.4	49	5.92	26.6	—
	N obs.	26	26	0	6	6	6	6	26	26	26	26	26	0	26	26	26	14	0
M497.2B	Mean	0.2	1.45	—	60	14	7	0	12.6	10.4	92	433	8.1	47.3	28	47.5	7.9	22.9	16.7
	Median	0.2	1.5	—	50	15	0	0	11.7	10.8	92	439	8	40	25	32.2	7.8	16.5	16.7
	Minimum	0.2	0.42	—	50	8	0	0	0.2	4.5	57	326	7.7	18	5	4.3	3	3.27	16.7
	Maximum	0.2	1.98	—	80	20	20	1	28	17.9	130	532	8.7	150	100	274	21.9	70.4	16.7
	Std. dev.	0	0.32	—	17.3	6.03	11.5	.58	10.4	3.75	17.6	61.9	0.25	27.7	21.1	56.4	4.25	17.6	—
	N obs.	26	26	0	3	3	3	3	26	26	26	26	26	22	26	26	26	26	1
M508.1F	Mean	0.2	1.66	0	100	20	50	2	13.4	13.1	123	505	8.3	52.7	17	20.9	11	72.6	82.8
	Median	0.2	1.49	0	100	20	50	1	12.4	12.1	115	489	8.4	50	15	21.1	10.7	74.8	82.8
	Minimum	0.2	0.9	0	100	1	0	0	1.1	2	14	335	7.1	28	6	3.4	0.5	3.27	82.8
	Maximum	0.2	2.65	0.02	100	30	100	6	29.2	25	309	776	9.1	110	36	42.7	21.1	167	82.8
	Std. dev.	0	0.49	0.01	0	9.17	51	2.7	10.3	6.64	61.6	122	0.63	21.5	8.57	11	5.46	47.1	—
	N obs.	26	26	25	8	8	8	8	26	26	26	26	26	25	26	26	26	25	1
M511.4B	Mean	0.2	0.96	—	30	8	60	1	12.6	10.9	96	435	8.1	38.2	24	38.4	7.8	25.9	18.5
	Median	0.2	0.7	—	30	8	80	1	11.3	11.1	91	442	8.1	38	22	29.6	7.4	16.4	18.5
	Minimum	0.2	0.25	—	20	6	0	0	0.2	4.9	63	324	7.6	24	5	3.9	3.1	2.81	18.5
	Maximum	0.2	1.8	—	40	10	100	2	28.4	20.2	146	544	8.7	52	55	99.8	13.5	111	18.5
	Std. dev.	0	0.48	—	10	2	52.9	1	10.4	4.09	19.6	66.3	0.27	7.67	13.9	28	2.8	25	—
	N obs.	26	26	0	3	3	3	3	26	26	26	26	26	18	26	26	26	26	1

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1995 Near-surface measurements:																			
M525.5L	Mean	0.2	1.1	0.2	100	25	55	2	13	10.8	97	414	8.2	44.9	30	52.5	8.7	30	21.7
	Median	0.2	1.11	0.2	100	23	60	2	12.3	10.1	95	424	8.2	40	23	39.2	8.4	23.6	21.7
	Minimum	0.2	1	0.1	100	19	0	0	0	5.9	74	305	7.8	16	5	2.8	2.4	2.85	21.7
	Maximum	0.2	1.26	0.32	100	35	100	6	28.4	18.8	138	527	8.8	108	134	185	26.4	101	21.7
	Std. dev.	0	0.07	0.07	0	6.25	49.7	2.6	10.7	3.33	15.6	64.4	0.26	23.6	28.1	53.6	5.45	23.8	—
	N obs.	26	24	23	6	6	6	6	24	24	24	24	24	21	24	24	24	24	1
M532.3T	Mean	0.2	1.1	0.1	100	18	36	2	12.6	11.9	108	446	8.3	44.2	25	28.3	7.9	29.1	18.4
	Median	0.2	1.05	0.07	100	18	10	0	11.1	10.4	99	475	8.3	38.5	21	25.4	7.7	24.3	18.4
	Minimum	0.2	0.86	0.01	100	4	0	0	0.4	5.8	70	315	7.6	19	5	4.2	2.9	1.4	18.4
	Maximum	0.2	1.42	0.23	100	34	100	11	31.2	24.7	183	550	9	108	70	71	18	91.2	18.4
	Std. dev.	0	0.17	0.08	0	10.1	46	3.9	10.6	4.49	27.2	72.8	0.33	22.7	17.2	19.5	4.2	25	—
	N obs.	26	26	26	8	8	8	8	26	25	25	26	26	22	26	26	26	26	1
M540.2T	Mean	0.2	1.33	0.06	100	24	39	4	12.3	11.2	99	436	8.2	45	25	28.4	7.7	28.9	23
	Median	0.2	1.09	0.04	100	25	5	0	10.8	11.3	99	448	8.2	39	19	24.5	7.7	23.4	23
	Minimum	0.2	0.84	0	100	6	0	0	0	3.5	43	313	7.8	18	5	2.6	2.5	2.85	23
	Maximum	0.2	2.22	0.23	100	36	100	12	29.1	19	148	548	9	95	59	67.9	15.8	111	23
	Std. dev.	0	0.43	0.06	0	8.89	50.8	5.1	10.7	3.84	23.4	68.9	0.35	20.8	16.7	20.7	3.74	25.6	—
	N obs.	26	26	26	8	8	8	8	26	26	26	26	26	22	26	26	26	26	1
M541.7L	Mean	0.2	1.24	0.01	—	—	—	—	25.7	12.3	158	455	8.4	33.9	35	—	—	—	—
	Median	0.2	1.18	0	—	—	—	—	28.1	10.3	134	472	8.6	38	27	—	—	—	—
	Minimum	0.2	1	0	—	—	—	—	16	7.7	86	367	7.9	24	23	—	—	—	—
	Maximum	0.2	1.71	0.05	—	—	—	—	31.3	25	346	510	8.8	44	54	—	—	—	—
	Std. dev.	0	0.25	0.02	—	—	—	—	5.79	6.09	91.5	56	0.37	7.45	13.4	—	—	—	—
	N obs.	7	7	7	0	0	0	0	7	7	7	7	7	7	7	0	0	0	0
M543.6G	Mean	0.2	1.48	0	—	—	—	—	24.9	10	124	444	8.4	34.4	33	—	—	—	—
	Median	0.2	1.4	0	—	—	—	—	27.3	7.1	93	443	8.4	32	32	—	—	—	—
	Minimum	0.2	1.21	0	—	—	—	—	15.2	5.4	69	383	8.1	24	15	—	—	—	—
	Maximum	0.2	1.98	0.02	—	—	—	—	28.8	25	329	492	8.9	53	50	—	—	—	—
	Std. dev.	0	0.28	0.01	—	—	—	—	5.46	6.86	93	39.3	0.34	9.32	14.4	—	—	—	—
	N obs.	7	7	7	0	0	0	0	7	7	7	7	7	7	7	0	0	0	0
M544.6E	Mean	0.2	2.8	0.01	—	—	—	—	24.7	7.2	87	453	8.1	32.4	32	—	—	—	—
	Median	0.2	2.74	0	—	—	—	—	26.7	6.4	75	451	8	30	28	—	—	—	—
	Minimum	0.2	2.48	0	—	—	—	—	14.9	3.2	40	393	7.6	18	14	—	—	—	—
	Maximum	0.2	3.28	0.03	—	—	—	—	28.9	10.3	136	502	8.6	54	70	—	—	—	—
	Std. dev.	0	0.29	0.01	—	—	—	—	5.5	2.68	33.7	40.7	0.34	11.8	17.9	—	—	—	—
	N obs.	7	7	7	0	0	0	0	7	7	7	7	7	7	7	0	0	0	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1995 Near-surface measurements:																			
M545.5B	Mean	0.2	2.87	0.02	100	24	49	3	13.4	12.5	114	422	8.5	54.4	19	23.5	10.8	55.8	16.7
	Median	0.2	2.6	0.02	100	24	20	1	12.3	13.9	119	428	8.6	47	19	22.8	11.5	59.9	16.7
	Minimum	0.2	2.18	0	100	16	0	0	0.2	3	38	296	7.5	21	4	2.8	2.9	9.36	16.7
	Maximum	0.2	3.96	0.07	100	32	100	10	28.8	18.7	176	548	9.2	110	46	50.2	21.9	118	16.7
	Std. dev.	0	0.54	0.02	0	5.5	48.8	3.9	10.6	4.79	40.1	71.6	0.51	24.1	10.4	12.4	5.12	29.3	—
	N obs.	26	25	24	7	7	7	6	25	25	25	25	25	25	25	25	25	25	1
M551.3N	Mean	0.2	3.29	0.23	—	—	—	—	20.2	8.29	90	412	8.1	33.3	38	—	—	—	—
	Median	0.2	3.24	0.2	—	—	—	—	21.7	7.7	94	420	8.2	33.5	36	—	—	—	—
	Minimum	0.2	2.4	0.06	—	—	—	—	3.5	5	62	312	7.7	16	23	—	—	—	—
	Maximum	0.2	4.57	0.49	—	—	—	—	29.9	12.2	116	527	8.4	46	92	—	—	—	—
	Std. dev.	0	0.64	0.14	—	—	—	—	8.58	2.15	15.5	75.1	0.22	8.03	17.2	—	—	—	—
	N obs.	14	14	13	0	0	0	0	14	13	13	14	14	14	14	0	0	0	0
M556.4A	Mean	0.2	1.98	—	50	11	0	0	11.9	11.1	96	417	8.1	56.8	19	25.4	6.5	25.2	15.1
	Median	0.2	1.83	—	50	11	0	0	11	11.4	92	425	8	48	21	27.9	6.9	19.6	15.1
	Minimum	0.2	1.2	—	20	2	0	0	0	4.8	61	309	7.4	30	5	3	2.4	3.27	15.1
	Maximum	0.2	2.9	—	80	20	0	0	27.2	19.5	154	529	8.8	128	42	49.4	9.8	74.4	15.1
	Std. dev.	0	0.47	—	42.4	12.7	0	0	10.7	3.9	20.1	66.2	0.33	25.5	9.86	14.9	2.12	19.5	—
	N obs.	26	26	0	2	2	2	2	26	26	26	26	26	24	26	26	26	26	1
M563.9T	Mean	0.2	0.69	0.03	100	23	63	4	13.1	11.4	103	416	8.2	34.1	30	38.6	8.8	30.5	14.6
	Median	0.2	0.64	0.01	100	25	75	5	12.6	12	98	417	8.2	31	22	30.6	8.6	26.2	14.6
	Minimum	0.2	0.4	0	100	12	0	0	0	3.7	46	305	7.7	18	5	4	3.2	1.6	14.6
	Maximum	0.2	1.3	0.12	100	30	100	8	30.3	20	162	554	9	52	170	225	27.7	102	14.6
	Std. dev.	0	0.24	0.04	0	7.03	43.2	3.5	11.1	4.05	27	71.6	0.33	11.7	32.7	43.2	5.17	24.8	—
	N obs.	25	25	25	6	6	6	6	25	25	25	25	25	18	25	25	25	25	1
M564.5T	Mean	0.2	0.87	0	100	18	67	4	3.37	13.9	106	491	8.1	61.8	11	17.1	10.5	64.2	30.1
	Median	0.2	0.78	0	100	17	75	3	2.3	15.4	112	498	8	61	8	11.9	11.2	76.3	30.1
	Minimum	0.2	0.7	0	100	10	0	0	1.6	3	21	323	7.4	45	6	5	4.4	6.55	30.1
	Maximum	0.2	1.25	0	100	26	100	10	8.5	20.7	177	577	9.3	80	23	37.9	16.8	125	30.1
	Std. dev.	0	0.19	0	0	5.99	37.8	4	2.38	6.46	53.5	86	0.75	17.8	6.18	13.1	5.65	48.5	—
	N obs.	7	7	7	6	6	6	6	7	7	7	7	7	4	7	5	5	5	1
M574.2D	Mean	0.2	2.7	0.54	—	—	—	—	16	9.44	92	410	8.1	46.2	25	37.6	7.9	29.1	—
	Median	0.2	2.74	0.54	—	—	—	—	17.2	9	90	417	8.1	44	26	36.1	7.9	22.5	—
	Minimum	0.2	1	0.17	—	—	—	—	0.1	5	63	309	7.7	30	14	19.8	4.5	5.13	—
	Maximum	0.2	3.96	0.82	—	—	—	—	27.6	15.9	148	527	8.8	76	41	58.2	12	130	—
	Std. dev.	0	0.7	0.19	—	—	—	—	9.31	2.92	17.7	74.5	0.28	10.1	6.31	11.2	1.88	27.5	—
	N obs.	19	19	14	0	0	0	0	19	19	19	19	19	19	19	19	19	19	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1995 Near-surface measurements:																			
M582.5B	Mean	0.2	2.53	—	96	9	0	0	11.7	11.3	98	422	8.2	52.5	20	28.5	6.7	29	9.17
	Median	0.2	2.76	—	100	10	0	0	11.1	10.8	91	431	8.1	42	21	32.8	6.9	26.4	9.17
	Minimum	0.2	1	—	80	3	0	0	0	5.4	68	313	7.7	30	4	2.7	2.1	2.81	9.17
	Maximum	0.2	4.57	—	100	16	0	0	27.3	20.2	169	526	8.8	122	39	72.2	9.8	102	9.17
	Std. dev.	0	0.98	—	8.94	5.08	0	0	10.6	3.99	22.5	65.2	0.29	23.4	10.2	17.8	2.41	22.7	—
	N obs.	26	26	0	5	5	5	5	26	25	25	26	26	22	26	26	26	26	1
MQ02.1M	Mean	0.2	0.88	—	100	16	36	16	11.5	10.7	98	596	8.1	—	97	159	18.3	26.8	—
	Median	0.2	0.76	—	100	15	1	0	10.2	10.9	93	603	8	—	34	57.7	9	9.27	—
	Minimum	0.2	0.4	—	100	8	0	0	0	7.3	73	508	7.6	—	6	7.6	1.8	4.28	—
	Maximum	0.2	1.85	—	100	20	100	80	28.3	14	180	700	8.5	—	1170	1722	187	74.8	—
	Std. dev.	0	0.43	—	0	4.93	49.6	36	10.3	1.75	24	48.4	0.26	—	231	344	36.4	26.3	—
	N obs.	26	26	0	5	5	5	5	26	26	26	26	26	0	26	26	26	13	0
PR03.2M	Mean	0.2	1.62	—	100	8	33	1	10.5	9.92	85	682	7.9	—	33	46.2	7	8.38	—
	Median	0.2	1.5	—	100	9	5	0	10.4	9.75	85	687	7.9	—	26	29.1	5.5	8.02	—
	Minimum	0.2	1.08	—	100	1	0	0	0	6.4	76	569	7.5	—	6	4.7	-0.1	-1	—
	Maximum	0.2	2.72	—	100	13	100	2	23.9	14	98	758	8.2	—	185	306	30.5	17.8	—
	Std. dev.	0	0.43	—	0	4.82	48	.84	9.03	2.48	6.36	40.9	0.16	—	38.8	65.6	5.94	6.14	—
	N obs.	26	25	0	6	6	6	6	26	26	26	26	26	0	26	26	26	14	0
RC01.7M	Mean	0.2	0.51	—	—	—	—	—	10.4	10.9	94	684	8	—	44	72	8.8	6.61	—
	Median	0.2	0.45	—	—	—	—	—	9.4	10.6	94	683	8	—	22	29.6	6.3	7.49	—
	Minimum	0.2	0.3	—	—	—	—	—	0	8.1	80	577	7.7	—	6	4.3	1.8	1.25	—
	Maximum	0.2	1	—	—	—	—	—	25.7	14.4	133	821	8.4	—	265	441	44.5	12.5	—
	Std. dev.	0	0.19	—	—	—	—	—	9.37	2.23	10.3	47.1	0.19	—	57.6	103	9.13	3.54	—
	N obs.	26	26	0	0	0	0	0	26	26	26	26	26	0	26	26	26	14	0
WP02.6M	Mean	0.2	0.92	—	100	27	50	3	11.8	11.3	104	466	8.2	—	39	77.6	15.7	140	—
	Median	0.2	0.69	—	100	28	50	3	11.7	11.3	92	473	8.1	—	33	74.9	16.1	146	—
	Minimum	0.2	0.4	—	100	15	0	0	0	7.8	72	329	7.5	—	5	4.6	1.5	-1	—
	Maximum	0.2	2.1	—	100	40	100	9	28.2	15.1	158	654	9	—	105	195	33.8	335	—
	Std. dev.	0	0.56	—	0	8.39	54.8	3.9	10.3	1.72	27.3	86.9	0.45	—	27.2	58.2	10.1	104	—
	N obs.	26	26	0	6	6	6	6	26	26	26	26	26	0	26	26	26	14	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1995 Middepth measurements:																			
M545.5B	Mean	1.43	2.87	—	—	—	—	—	19.5	6.69	71	427	8.1	—	—	—	—	—	—
	Median	1.5	3.05	—	—	—	—	—	20.3	7.7	67	415	8	—	—	—	—	—	—
	Minimum	1.1	2.18	—	—	—	—	—	1.7	2.5	32	333	7.5	—	—	—	—	—	—
	Maximum	1.8	3.66	—	—	—	—	—	27.9	10.3	113	506	8.9	—	—	—	—	—	—
	Std. dev.	0.27	0.57	—	—	—	—	—	9.28	3.12	31.3	60	0.56	—	—	—	—	—	—
	N obs.	7	7	0	—	—	—	—	7	7	7	7	7	—	0	0	0	0	0
1995 Near-bottom measurements:																			
M545.5B	Mean	2.68	2.87	0	—	—	—	—	12.5	9.44	80	430	8.2	—	24	27.3	10.6	51.5	15.9
	Median	2.4	2.6	0	—	—	—	—	12	9.3	69	440	8	—	22	27.6	10.1	65.5	15.9
	Minimum	2	2.18	0	—	—	—	—	1	1	13	299	7.4	—	11	8.6	3.7	15.9	15.9
	Maximum	3.8	3.96	0	—	—	—	—	27	17.6	142	549	9.8	—	46	53.1	17.7	88.4	15.9
	Std. dev.	0.55	0.54	0	—	—	—	—	9.49	5.82	42.6	72	0.63	—	11.1	13.6	4.5	31.6	—
	N obs.	25	25	23	—	—	—	—	25	25	25	24	24	—	7	7	7	5	1
1996 Near-surface measurements:																			
AL02.3M	Mean	0.2	3.31	—	95	6	17	0	11.6	10.7	96	614	8.2	—	28	31.8	6.7	17.8	—
	Median	0.2	3.1	—	100	4	0	0	12.2	9.6	93	635	8.1	—	24	28	6.3	5.05	—
	Minimum	0.2	2.1	—	80	1	0	0	0.1	7.7	66	440	7.5	—	5	3.2	2.3	-1	—
	Maximum	0.2	5.5	—	100	13	100	2	25.5	15.9	137	706	9.2	—	122	157	20	102	—
	Std. dev.	0	0.8	—	8.37	5.5	40.8	.82	8.97	2.46	16.6	72.2	0.36	—	25.1	31.4	3.88	28.2	—
	N obs.	25	24	0	6	6	6	6	24	24	24	24	24	0	24	24	24	23	0
M497.2B	Mean	0.2	1.53	—	90	2	0	0	12	9.52	84	386	7.9	54	35	45.8	8.1	14.5	—
	Median	0.2	1.5	—	90	2	0	0	11.6	9.2	85	374	7.8	50	21	23.2	6.1	11	—
	Minimum	0.2	1.2	—	90	2	0	0	0.1	5.7	68	273	7.5	10	3	4	2.9	-1	—
	Maximum	0.2	2.38	—	90	2	0	0	26.5	13.2	99	491	8.5	130	350	445	50.3	45.6	—
	Std. dev.	0	0.27	—	—	—	—	—	9.81	2.41	7.86	54.8	0.26	28.1	66.9	85.9	9.2	13.8	—
	N obs.	25	25	0	1	1	1	1	25	25	25	25	25	22	25	25	25	25	0
M508.1F	Mean	0.2	1.73	0.03	100	17	43	1	12.8	12.9	121	431	8.3	53.2	22	25.9	11.3	66.9	—
	Median	0.2	1.46	0	100	20	35	0	10.8	10.8	101	421	8.1	45	22	24	11.1	57.8	—
	Minimum	0.2	1.2	0	100	3	0	0	0.6	5.6	39	264	7.2	25	4	3	3.8	2.9	—
	Maximum	0.2	3.3	0.55	100	30	100	2	28.6	25	317	734	9.4	110	61	54.1	19.5	192	—
	Std. dev.	0	0.56	0.11	0	10.8	45.9	1	9.9	6.12	62.2	104	0.69	23.3	13.4	14.5	4.93	56.6	—
	N obs.	25	25	25	6	6	6	6	25	25	25	25	25	25	25	25	24	25	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1996 Near-surface measurements:																			
M511.4B	Mean	0.2	0.97	—	—	—	—	—	12.3	9.78	87	386	7.9	40.9	36	46.5	8	14.2	—
	Median	0.2	0.7	—	—	—	—	—	11.5	9.3	88	380	7.8	35	26	30.7	6.8	11.1	—
	Minimum	0.2	0.32	—	—	—	—	—	0.6	5.5	68	262	7.2	10	4	3.1	3	-1	—
	Maximum	0.2	2.8	—	—	—	—	—	28	13.3	103	491	8.5	90	310	352	33.8	63.1	—
	Std. dev.	0	0.6	—	—	—	—	—	10.2	2.54	8.52	58.4	0.3	22.5	58.9	68	6.17	14.1	—
	N obs.	25	25	0	0	0	0	0	25	25	25	25	25	13	25	25	25	25	0
M525.5L	Mean	0.2	1.14	0.19	100	40	100	4	13.6	9.86	92	361	8.1	47.1	32	52.1	8.7	24.1	—
	Median	0.2	1.1	0.18	100	40	100	4	14.4	9.9	92	359	8.1	46	19	28.5	6.7	22	—
	Minimum	0.2	0.92	0.08	100	36	100	3	0.1	6.1	72	227	7.5	15	5	3	2.8	1.43	—
	Maximum	0.2	2.3	0.37	100	44	100	4	26.1	13.2	110	448	8.9	90	196	421	40.7	66.9	—
	Std. dev.	0	0.28	0.08	0	5.66	0	.71	9.35	2.24	10.2	53.5	0.35	17.7	39.3	86.9	7.72	15.8	—
	N obs.	23	21	18	2	2	2	2	21	21	21	21	21	20	21	21	21	20	0
M532.3T	Mean	0.2	1.12	0.08	98	11	40	1	12.9	10.4	95	396	8.2	41.1	27	30.8	7.4	23.3	—
	Median	0.2	1.05	0.06	100	11	10	0	14.4	9.95	92	397	8.3	38	25	28.2	7.3	23.5	—
	Minimum	0.2	0.75	0	90	1	0	0	0.1	6.7	68	222	7.6	20	4	2.1	2.7	1.43	—
	Maximum	0.2	2.5	0.2	100	25	100	2	26.8	14.4	128	489	8.7	70	62	65.6	12.9	52.7	—
	Std. dev.	0	0.37	0.06	4.47	9.81	50.5	1.1	9.42	2.44	15.2	62.3	0.32	14.8	15.5	18.8	3.07	14.4	—
	N obs.	23	22	21	5	5	5	5	22	22	22	22	22	20	22	22	22	22	0
M540.2T	Mean	0.2	1.37	0.08	96.7	27	50	2	11.9	9.65	85	379	8.1	43.7	31	35.9	8.2	17.7	—
	Median	0.2	1.18	0.04	100	34	50	0	12	9.9	84	381	8	36	25	29.1	7.5	18	—
	Minimum	0.2	0.65	0	80	1	0	0	0	4.3	52	208	7.6	18	4	3.7	2.6	1.71	—
	Maximum	0.2	2.9	0.63	100	42	100	8	25.7	14.3	128	490	8.7	110	82	101	18.1	57.7	—
	Std. dev.	0	0.57	0.13	8.16	16	44.7	3.2	9.7	2.78	15.1	60.9	0.31	23.5	21.9	26.9	4.37	13.9	—
	N obs.	24	24	23	6	6	6	6	24	24	24	24	24	23	24	24	23	24	0
M545.5B	Mean	0.2	2.85	0.01	100	25	47	2	12.5	11.6	104	392	8.4	64	15	18.2	9.8	47	—
	Median	0.2	2.6	0	100	32	45	1	13.3	10.4	98	398	8.2	59	15	16.5	9.6	38.1	—
	Minimum	0.2	2.03	0	100	1	0	0	0.1	5.4	65	260	7.5	35	4	1.8	2.4	-1	—
	Maximum	0.2	4.9	0.1	100	39	100	10	26.5	25	193	527	9.4	130	30	42.4	19.2	133	—
	Std. dev.	0	0.72	0.02	0	15.1	42.7	3.9	9.23	4.81	33.7	74.5	0.58	26.2	7.54	10.2	4.86	36.7	—
	N obs.	24	24	24	6	6	6	6	24	24	24	24	24	24	24	24	23	24	0
M551.3N	Mean	0.2	2.44	0.15	—	—	—	—	20.8	8.27	91	374	8.1	36.7	33	—	—	—	—
	Median	0.2	2.5	0.14	—	—	—	—	23.9	8.1	86	364	8.1	32	30	—	—	—	—
	Minimum	0.2	1.41	0	—	—	—	—	8.6	4.2	50	292	7.6	21	13	—	—	—	—
	Maximum	0.2	3.35	0.42	—	—	—	—	27.6	14.6	125	472	8.6	62	58	—	—	—	—
	Std. dev.	0	0.64	0.14	—	—	—	—	5.67	2.6	20.4	49.5	0.34	12.4	13	—	—	—	—
	N obs.	15	15	15	0	0	0	0	15	15	15	15	15	15	15	0	0	0	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1996 Near-surface measurements:																			
M556.4A	Mean	0.2	2.08	—	83.3	10	33	0	11.9	9.68	86	359	8	62.4	18	27.9	6.4	16.7	—
	Median	0.2	1.72	—	80	4	0	0	12.2	10.2	86	350	8.1	54	18	22.4	5.9	13.9	—
	Minimum	0.2	1.36	—	70	2	0	0	0	5.8	69	251	7.4	31	5	2.9	2.4	-1	—
	Maximum	0.2	5.1	—	100	25	100	1	26.5	12.7	115	481	8.9	170	38	101	20.3	58.3	—
	Std. dev.	0	0.85	—	15.3	12.7	57.7	.58	9.9	2.26	11.9	54.7	0.36	30.9	7.77	21.4	3.49	14.3	—
	N obs.	24	24	0	3	3	3	3	24	24	24	24	24	23	23	24	24	24	0
M563.9T	Mean	0.2	0.84	0.05	100	23	50	0	14.1	10.3	98	364	8.2	42.6	27	28.8	7.3	22.7	—
	Median	0.2	0.66	0.02	100	23	50	0	15.1	10.9	97	356	8.2	38	23	26.8	7.3	17.7	—
	Minimum	0.2	0.48	0	100	8	0	0	0.1	4.7	42	202	7.5	18	5	3.9	2.8	2.19	—
	Maximum	0.2	2.5	0.33	100	38	100	0	27.6	15.3	155	470	9	72	85	55.1	11.4	55.1	—
	Std. dev.	0	0.46	0.08	0	21.2	70.7	—	9.51	3.43	28.9	66.7	0.41	14.7	17.1	13.7	2.32	14	—
	N obs.	22	21	21	2	2	2	1	21	21	21	21	21	19	21	21	20	20	0
M582.5B	Mean	0.2	1.53	—	86	16	39	1	11.2	9.82	87	369	8	67.3	22	29.2	6.6	16.2	—
	Median	0.2	1.5	—	100	18	0	0	10.3	9.8	88	361	8	57.5	20	28.8	6.5	11.5	—
	Minimum	0.2	1.2	—	30	2	0	0	0	5.8	62	263	7.4	16	3	1.9	2.5	-1	—
	Maximum	0.2	3	—	100	25	100	5	25.7	14.9	119	477	9.1	160	104	103	16.2	64.4	—
	Std. dev.	0	0.32	—	31.3	8.61	53.4	2.2	10.1	2.24	14.8	54.3	0.38	34.8	19.1	21.2	2.89	16.9	—
	N obs.	25	25	0	5	5	5	5	25	25	25	25	25	24	25	25	23	25	0
MQ02.1M	Mean	0.2	0.98	—	98.8	24	100	5	11.5	10.6	97	564	8.1	—	138	382	30.5	29.9	—
	Median	0.2	0.8	—	100	29	100	4	10.3	10.3	94	587	8.2	—	28	47.8	9.2	16.6	—
	Minimum	0.2	0.3	—	95	2	100	3	0	7.6	52	316	7.3	—	8	8.5	3.3	-1	—
	Maximum	0.2	2.5	—	100	36	100	8	25.8	14.6	150	693	8.6	—	1020	3772	236	95.9	—
	Std. dev.	0	0.61	—	2.5	15.8	0	2.6	9.57	1.8	24.2	96.7	0.34	—	281	961	57.1	30.9	—
	N obs.	25	25	0	4	4	3	3	25	25	25	25	25	0	25	25	24	24	0
PR03.2M	Mean	0.2	1.46	—	100	8	18	0	10.1	10	86	649	7.9	—	37	46.3	7.7	6.71	—
	Median	0.2	1.4	—	100	6	0	0	10.6	9.3	87	671	8	—	26	28	6.1	4.93	—
	Minimum	0.2	0.85	—	100	1	0	0	0	5.7	62	337	7.6	—	5	4.3	2.5	-1	—
	Maximum	0.2	2.58	—	100	21	80	0	22.8	14.8	119	750	8.2	—	128	140	18	25	—
	Std. dev.	0	0.51	—	0	8.29	34.9	0	8.4	2.32	11.9	91.7	0.17	—	32.5	39.7	4.79	5.6	—
	N obs.	25	25	0	5	5	5	5	25	25	25	25	25	0	25	25	24	25	0
RC01.7M	Mean	0.2	0.59	—	80	1	—	—	10.2	10.6	92	639	8.1	—	88	142	16.6	10.6	—
	Median	0.2	0.4	—	80	1	—	—	10.1	9.9	92	661	8.1	—	28	31.1	6	6.81	—
	Minimum	0.2	0.3	—	80	1	—	—	0	6.9	57	216	7.4	—	6	6.6	2.9	-1	—
	Maximum	0.2	1.7	—	80	1	—	—	24.4	15.6	139	770	8.5	—	1340	2383	213	63.6	—
	Std. dev.	0	0.45	—	—	—	—	—	8.66	2.51	16.2	109	0.25	—	263	469	42.1	13.3	—
	N obs.	25	25	0	1	1	0	0	25	25	25	25	25	0	25	25	24	25	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1996 Near-surface measurements:																			
RK00.1M	Mean	0.2	0.64	—	100	3	0	0	13	8.61	79	667	7.3	—	18	19.3	5.4	6.03	—
	Median	0.2	0.6	—	100	3	0	0	15.6	9	76	700	7.5	—	17	19.6	5.1	4.49	—
	Minimum	0.2	0.4	—	100	2	0	0	0.3	4.3	51	427	6	—	7	9.7	3.4	2.17	—
	Maximum	0.2	1.1	—	100	3	0	0	23.7	12.6	127	736	8	—	38	27.9	7.6	13.3	—
	Std. dev.	0	0.19	—	0	0.71	0	0	8.55	2.66	18.4	83	0.49	—	7.96	5.78	1.31	4.04	—
	N obs.	15	15	0	2	2	2	2	15	15	15	15	15	0	15	15	15	15	0
RK03.7M	Mean	0.2	0.3	—	—	—	—	—	12	10.9	99	633	7.8	—	10	12.5	4.3	5.12	—
	Median	0.2	0.3	—	—	—	—	—	14.5	10.7	101	638	7.8	—	8	10.4	3.9	1.68	—
	Minimum	0.2	0.3	—	—	—	—	—	0.4	7.8	81	584	7.1	—	3	4.9	2.5	-1	—
	Maximum	0.2	0.3	—	—	—	—	—	20.3	14.6	120	660	8.2	—	30	36.5	9.8	43.8	—
	Std. dev.	0	0	—	—	—	—	—	6.82	1.92	10.2	19.2	0.26	—	6.98	8.41	1.89	11.1	—
	N obs.	15	15	0	0	0	0	0	15	15	15	15	15	0	15	15	15	15	0
WP02.6M	Mean	0.2	1.03	—	98.3	21	67	2	11.2	10.8	99	413	8.1	—	226	455	41.2	95.3	—
	Median	0.2	0.85	—	100	28	100	2	10.4	11.1	89	393	7.8	—	56	106	21.4	30.4	—
	Minimum	0.2	0.4	—	95	3	0	0	0.1	4.5	46	220	7.4	—	5	5.5	3.8	1.43	—
	Maximum	0.2	2.7	—	100	33	100	3	25.8	16	174	610	9.1	—	2700	6966	380	348	—
	Std. dev.	0	0.57	—	2.89	16.1	57.7	1.5	9.5	2.77	35.6	103	0.54	—	569	1386	76.6	109	—
	N obs.	25	25	0	3	3	3	3	25	25	25	25	25	0	25	25	25	25	0
1996 Middepth measurements:																			
M545.5B	Mean	1.57	3.16	—	—	—	—	—	18.8	6.75	70	353	8.1	—	—	—	—	—	—
	Median	1.7	3.38	—	—	—	—	—	20.1	6.45	77	348	8.1	—	—	—	—	—	—
	Minimum	1	2.13	—	—	—	—	—	12.5	1.2	14	282	7.4	—	—	—	—	—	—
	Maximum	2	3.96	—	—	—	—	—	24.3	12.3	115	437	9	—	—	—	—	—	—
	Std. dev.	0.38	0.72	—	—	—	—	—	5.4	3.99	36.7	57.4	0.57	—	—	—	—	—	—
	N obs.	6	6	0	—	—	—	—	6	6	6	6	6	—	0	0	0	0	0
1996 Near-bottom measurements:																			
M508.1F	Mean	1.46	1.65	0	—	—	—	—	16	9.46	86	460	8.1	—	35	41.1	12	42.2	—
	Median	1.35	1.54	0	—	—	—	—	18.6	8.45	95	456	7.9	—	34	40.2	11	42.9	—
	Minimum	1	1.2	0	—	—	—	—	2.2	0.8	9	319	7.4	—	16	19.4	9	13.7	—
	Maximum	2.2	2.34	0	—	—	—	—	27.2	25	220	650	9.3	—	55	67.9	18.5	61.6	—
	Std. dev.	0.38	0.37	0	—	—	—	—	9.49	7.18	56.6	84.2	0.64	—	13	16.5	3.51	17.8	—
	N obs.	14	14	7	—	—	—	—	14	14	14	14	14	—	6	6	6	6	0

Table E-1. Continued.

Sampling location	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1996 Near-bottom measurements:																			
M545.5B	Mean	2.67	2.87	0	—	—	—	—	11.8	8.71	74	408	8	—	22	23.3	8.1	28.1	—
	Median	2.4	2.6	0	—	—	—	—	11.7	9.15	84	431	8	—	22	22.9	8.5	28.8	—
	Minimum	1.8	2.03	0	—	—	—	—	0.2	0.5	6	260	7.2	—	16	18	6.9	20.7	—
	Maximum	4.7	4.9	0	—	—	—	—	23.9	25	192	551	9.2	—	28	30.8	9	36.4	—
	Std. dev.	0.74	0.74	0	—	—	—	—	8.1	6.32	48.8	81.5	0.58	—	5.16	4.98	0.9	5.92	—
	N obs.	22	22	17	—	—	—	—	22	22	22	22	22	—	4	5	5	5	0

Table E-2. Annual summaries (1993–1996) of chemical measurements at fixed sites grouped into near-surface (less than or equal to 0.2 m below the surface) and near-bottom (less than or equal to 0.2 m above the substrate) categories. Below-surface chemical samples are infrequently collected.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1993 Near-surface measurements:													
AL02.3M	Mean	5.18	0.1	4.48	0.25	0.1	3.69	86.3	2.29	47.5	27.6	17.1	—
	Median	5.02	0.09	4.53	0.24	0.093	3.64	86	2.16	47.5	27.6	16.3	—
	Minimum	3.95	0.04	3.15	0.06	0.024	2.1	76	1.83	47.5	27.6	13.5	—
	Maximum	8.22	0.3	5.37	0.56	0.23	5.89	97	3.6	47.5	27.6	25	—
	Std. dev.	1.138	0.069	0.685	0.139	0.055	1.162	8.459	0.531	—	—	2.897	—
	N obs.	15	18	18	15	18	18	5	10	1	1	14	0
M497.2B	Mean	4.04	0.04	2.98	0.23	0.088	4.6	55.2	2.47	24.3	25.3	14.8	—
	Median	3.86	0.03	2.91	0.21	0.075	4.6	55.3	2.5	24.3	25.3	14.5	—
	Minimum	2.91	-0.02	1.83	0.096	-0.01	1.63	41.5	2.15	24.3	25.3	10	—
	Maximum	5.24	0.1	4.06	0.39	0.18	7.26	67.4	2.9	24.3	25.3	18.8	—
	Std. dev.	0.762	0.032	0.658	0.076	0.057	1.553	9.536	0.225	—	—	3.057	—
	N obs.	14	17	17	14	17	17	5	9	1	1	14	0
M508.1F	Mean	5.1	0.1	4.06	0.22	0.065	4.16	57.3	2.41	36.4	25.8	18	—
	Median	4.07	0.06	2.85	0.21	0.042	3.94	51.8	1.94	36.4	25.8	16.5	—
	Minimum	2.1	-0.02	1.58	0.074	-0.01	0.15	44.6	1.68	36.4	25.8	12.2	—
	Maximum	8.66	0.3	8.3	0.3	0.18	7.6	70.7	3.4	36.4	25.8	26.2	—
	Std. dev.	2.42	0.087	2.231	0.063	0.065	2.596	12.34	0.684	—	—	4.271	—
	N obs.	13	16	16	13	16	16	5	10	1	1	12	0
M511.4B	Mean	3.33	0.06	2.21	0.26	0.098	4.74	57.1	2.7	24	24	16.1	—
	Median	3.21	0.05	2.04	0.23	0.093	4.31	56.9	2.58	24	24	15.2	—
	Minimum	2.44	-0.02	1.13	0.12	-0.01	1.08	48.3	2.29	24	24	9.87	—
	Maximum	5.23	0.1	3.42	0.53	0.2	7.58	65.8	3.4	24	24	22.4	—
	Std. dev.	0.7	0.034	0.566	0.114	0.054	1.85	6.321	0.388	—	—	3.7	—
	N obs.	15	18	18	15	18	18	5	10	1	1	14	0
M525.5L	Mean	3.29	0.1	1.96	0.23	0.083	4.86	49.3	2.9	—	—	13.2	—
	Median	3.18	0.03	1.87	0.22	0.077	4.42	50.1	2.64	—	—	12.8	—
	Minimum	1.99	-0.02	0.94	0.075	-0.01	0.93	34.6	2.21	—	—	8.39	—
	Maximum	5.11	0.8	2.87	0.41	0.18	7.43	57.4	4.6	—	—	17.2	—
	Std. dev.	0.755	0.194	0.536	0.088	0.054	1.677	7.695	0.588	—	—	2.376	—
	N obs.	18	22	22	18	22	22	8	14	0	0	13	0
M532.3T	Mean	2.63	0.07	1.47	0.18	0.064	3.57	49.3	2.49	33	11.5	14.3	—
	Median	2.5	0.02	1.68	0.19	0.039	3.35	47	2.6	33	11.5	14	—
	Minimum	1.23	-0.02	-0.01	0.046	-0.01	-0.05	36	1.4	33	11.5	9.8	—
	Maximum	5.97	0.7	3.29	0.34	0.24	7.5	71.1	3.1	33	11.5	21	—
	Std. dev.	1.126	0.146	0.95	0.078	0.066	2.417	12.09	0.477	—	—	3.09	—
	N obs.	19	23	23	19	23	23	9	15	1	1	14	0

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1993 Near-surface measurements:													
M540.2T	Mean	2.93	0.05	1.71	0.2	0.073	4.53	56	2.75	33.8	8.57	13.4	—
	Median	2.87	0.04	1.78	0.2	0.061	4.1	56	2.7	33.8	8.57	13.7	—
	Minimum	0.87	-0.02	0.17	0.079	-0.01	0.82	36.3	2.18	33.8	8.57	8.64	—
	Maximum	4.47	0.2	2.97	0.32	0.16	7.15	77.3	3.3	33.8	8.57	18.5	—
	Std. dev.	0.764	0.042	0.608	0.065	0.048	1.811	12.4	0.328	—	—	2.556	—
	N obs.	19	22	22	19	22	22	8	14	1	1	14	0
M545.5B	Mean	2.57	0.04	1.09	0.21	0.054	3.08	62.1	2.76	27.3	10.8	12.2	—
	Median	2.2	0.03	0.32	0.22	0.021	3.05	61.9	2.9	27.3	10.8	11.6	—
	Minimum	1.16	-0.02	-0.01	0.075	-0.01	0.27	61	2.09	27.3	10.8	9.19	—
	Maximum	5.2	0.1	3.2	0.32	0.18	6.93	62.8	3.2	27.3	10.8	18.1	—
	Std. dev.	1.095	0.032	1.276	0.069	0.057	1.713	0.798	0.434	—	—	2.596	—
	N obs.	15	17	17	15	17	17	4	9	1	1	13	0
M556.4A	Mean	3.01	0.05	1.95	0.21	0.084	5.02	54.6	2.62	24	24.9	14.5	—
	Median	3.17	0.05	1.86	0.24	0.059	4.69	54.9	2.56	24	24.9	13.3	—
	Minimum	1.65	-0.02	0.95	0.096	-0.01	1.11	50.5	2.18	24	24.9	10.3	—
	Maximum	4.12	0.1	2.88	0.36	0.19	7.66	57.2	3.2	24	24.9	24.9	—
	Std. dev.	0.707	0.027	0.502	0.074	0.057	1.936	2.598	0.327	—	—	3.813	—
	N obs.	15	18	18	15	18	18	5	10	1	1	14	0
M563.9T	Mean	2.81	0.05	1.63	0.2	0.073	4.5	54.5	2.72	—	—	13.2	—
	Median	2.74	0.05	1.72	0.2	0.063	3.89	54	2.86	—	—	13.1	—
	Minimum	2.37	-0.02	0.85	0.093	-0.01	0.82	52.1	2.14	—	—	8.69	—
	Maximum	3.54	0.1	2.38	0.38	0.16	7.05	57.6	3.1	—	—	16.4	—
	Std. dev.	0.366	0.031	0.414	0.069	0.05	1.708	2.304	0.344	—	—	2.469	—
	N obs.	14	17	17	14	17	17	4	9	0	0	13	0
M574.2D	Mean	3.17	0.06	2.02	0.24	0.088	5.07	55.4	2.65	—	—	13.7	—
	Median	3.09	0.07	1.91	0.19	0.085	4.76	55.4	2.64	—	—	13.2	—
	Minimum	2.6	0.02	0.99	0.095	-0.01	1.32	52.5	2.23	—	—	10.6	—
	Maximum	4.25	0.1	3	0.56	0.19	7.74	57.8	3.2	—	—	17.5	—
	Std. dev.	0.456	0.026	0.537	0.127	0.059	1.865	2.201	0.324	—	—	2.101	—
	N obs.	14	17	17	14	17	17	4	9	0	0	13	0
M582.5B	Mean	3.14	0.03	2.14	0.21	0.083	5.18	51.7	2.59	23.7	25.4	14	—
	Median	3.06	0.02	2.04	0.18	0.068	4.69	55.4	2.59	23.7	25.4	13.8	—
	Minimum	2.07	-0.02	1.23	0.061	-0.01	1.56	43.2	2	23.7	25.4	11.2	—
	Maximum	4.23	0.08	3.44	0.45	0.19	8.02	56.9	3.1	23.7	25.4	18.3	—
	Std. dev.	0.641	0.026	0.592	0.109	0.061	1.822	6.264	0.338	—	—	2.079	—
	N obs.	14	17	17	14	17	17	5	10	1	1	13	0

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1993 Near-surface measurements:													
MQ02.1M	Mean	7.72	0.05	7.6	0.29	0.14	5.58	93.1	2.15	38	27.4	15	—
	Median	7.7	0.03	7.7	0.29	0.14	5.7	87.4	2.06	38	27.4	15.3	—
	Minimum	5.23	-0.02	5.59	0.08	0.053	2.79	79.5	1.63	38	27.4	7.64	—
	Maximum	10.4	0.3	9.15	0.51	0.27	7.3	113	2.5	38	27.4	17	—
	Std. dev.	1.395	0.068	0.926	0.136	0.065	1.11	13.38	0.267	—	—	2.217	—
	N obs.	15	18	17	15	18	18	5	10	1	1	14	0
PR03.2M	Mean	6.79	0.1	6.21	0.24	0.081	5.34	71.2	2.74	47.6	27.6	20.5	—
	Median	6.94	0.09	6.12	0.23	0.077	5.35	80.3	2.49	47.6	27.6	19.5	—
	Minimum	5.15	-0.02	4.75	0.046	-0.01	3.25	31.4	1.74	47.6	27.6	13.8	—
	Maximum	7.99	0.8	7.54	0.53	0.17	7.27	88.8	4.4	47.6	27.6	35.1	—
	Std. dev.	0.751	0.178	0.817	0.139	0.05	0.908	23.48	0.869	—	—	4.864	—
	N obs.	15	17	17	15	17	17	5	10	1	1	14	0
RC01.7M	Mean	4.29	0.09	3.65	0.32	0.14	5.45	90.3	2.69	49.9	25.2	17.7	—
	Median	3.97	0.08	3.56	0.29	0.13	5.51	88.8	2.43	49.9	25.2	17.4	—
	Minimum	2.87	-0.02	2.32	0.069	0.037	3.55	86.5	1.88	49.9	25.2	15.1	—
	Maximum	7.28	0.4	4.8	0.85	0.3	7.38	96	4.2	49.9	25.2	23.6	—
	Std. dev.	1.167	0.079	0.716	0.192	0.066	0.973	3.841	0.708	—	—	2.147	—
	N obs.	15	18	18	15	18	18	5	10	1	1	14	0
WP02.6M	Mean	6.37	0.05	5.56	0.28	0.099	4.84	80.4	2.15	28.7	26.8	15.3	—
	Median	6.65	0.03	5.5	0.23	0.072	4.75	79.4	1.84	28.7	26.8	15.4	—
	Minimum	3.85	-0.02	3.53	0.072	0.017	2.72	69.5	1.48	28.7	26.8	8.68	—
	Maximum	9.36	0.2	7.93	0.73	0.3	6.62	90.6	5.3	28.7	26.8	25.7	—
	Std. dev.	1.33	0.05	1.178	0.174	0.077	1.05	7.957	1.122	—	—	4.823	—
	N obs.	15	18	18	15	18	18	5	10	1	1	14	0
1994 Near-surface measurements:													
AL02.3M	Mean	3.67	0.1	3.71	0.22	0.033	3.54	68.9	2.62	39.4	7.76	15.7	26.6
	Median	3.46	0.06	3.97	0.17	0.016	3.94	67.9	2.52	39.9	7.23	13.5	27.7
	Minimum	1.7	-0.02	0.83	0.069	-0.01	-0.05	54.5	1.38	29.7	3.08	9.56	0
	Maximum	6.47	0.6	11	1.19	0.22	5.51	80.9	5.7	44.8	27.6	48.7	45.4
	Std. dev.	1.181	0.135	2.065	0.212	0.045	1.57	6.192	0.975	3.755	4.311	7.275	7.611
	N obs.	26	26	26	26	26	26	26	26	26	26	26	23

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1994 Near-surface measurements:													
M497.2B	Mean	2.62	0.1	2.12	0.19	0.037	3.95	47.4	2.92	19	10.3	14.5	35.2
	Median	2.46	0.05	2.13	0.16	0.03	4.45	45.6	2.82	18	9.94	13.3	32.4
	Minimum	1.4	-0.02	0.38	0.062	-0.01	0.14	35.8	2.24	13.9	5.86	7.99	24.6
	Maximum	4.87	0.8	7.39	0.59	0.2	6.6	64.4	4.53	24.4	13.1	24.3	64.3
	Std. dev.	0.87	0.168	1.509	0.112	0.041	1.871	7.861	0.54	3.074	1.602	3.497	10.32
	N obs.	26	26	26	26	26	26	26	26	26	26	26	23
M508.1F	Mean	4.08	0.3	2.9	0.21	0.03	3.16	44.9	2.81	23	10.5	16.9	38
	Median	2.87	0.03	2.46	0.16	0.018	3.25	43.4	2.67	23.2	11.3	15.7	35.6
	Minimum	1.62	-0.02	0.13	0.053	-0.01	-0.05	2.47	1.91	1.03	0.84	11.5	17.9
	Maximum	12.4	2.4	11.8	0.57	0.23	6.57	74.3	5.6	35.9	15.9	27.3	126
	Std. dev.	2.789	0.577	2.895	0.134	0.049	1.656	14.09	0.755	7.785	3.426	4.093	19.92
	N obs.	26	25	25	26	26	26	26	26	26	26	26	23
M511.4B	Mean	2.44	0.1	1.65	0.26	0.05	4.17	45.9	3.04	19.4	12.7	15.4	34.2
	Median	2.32	0.07	1.65	0.18	0.038	4.52	43.9	3	19.9	12.5	14.1	31.2
	Minimum	1.7	-0.02	0.43	0.069	-0.01	0.16	37.7	2.22	14.3	9.16	11.6	18.7
	Maximum	4.38	0.9	3.88	1.18	0.27	6.29	60.9	4.2	25	24.4	24.9	55.3
	Std. dev.	0.66	0.194	0.809	0.249	0.053	1.769	6.267	0.528	2.996	2.995	3.129	8.952
	N obs.	26	26	26	26	26	26	26	26	26	26	26	23
M525.5L	Mean	2.26	0.1	1.41	0.21	0.037	4.11	44.8	2.81	18.9	10	13.6	37.6
	Median	2.09	0.04	1.38	0.2	0.032	4.67	43.9	2.7	19.1	10.1	11.9	31.3
	Minimum	1.48	-0.02	0.46	0.071	-0.01	0.051	37.8	1.98	15.3	7.34	7.43	21.3
	Maximum	3.83	0.7	2.32	0.71	0.13	6.44	57.6	4.44	24.1	13.4	25.2	137
	Std. dev.	0.565	0.162	0.606	0.137	0.034	1.879	5.066	0.563	2.776	1.676	4.096	23.68
	N obs.	25	25	25	25	25	25	25	25	25	25	25	22
M532.3T	Mean	2.72	0.1	1.46	0.21	0.034	4.22	47.3	2.92	21.7	10.1	14	36.3
	Median	2.42	0.03	1.25	0.19	0.03	4.76	45.6	2.91	22	9.52	12.2	30.9
	Minimum	1.29	-0.02	-0.01	0.073	-0.01	0.61	32	1.89	15.2	6.02	9.65	24.1
	Maximum	6.32	1	3.21	0.55	0.12	6.02	67	4.9	32	25.4	23.8	104
	Std. dev.	1.173	0.218	0.895	0.119	0.028	1.622	8.754	0.71	4.453	3.606	3.755	17.08
	N obs.	25	25	25	25	25	25	25	25	25	25	25	22
M540.2T	Mean	2.26	0.1	1.44	0.21	0.035	4.26	46.8	2.92	21.3	9.95	13.1	32.5
	Median	2.24	0.04	1.62	0.18	0.03	4.74	45.6	2.85	21.2	9.42	12.3	31.5
	Minimum	0.96	-0.02	0.21	0.061	-0.01	0.18	35.1	2.13	15.4	6.11	8.86	23.3
	Maximum	3.97	0.8	2.61	0.6	0.16	6.51	58.4	4.11	28	26	23.9	46.5
	Std. dev.	0.603	0.181	0.659	0.125	0.033	1.779	6.589	0.5	3.634	3.453	3.026	6.155
	N obs.	27	27	27	27	27	27	27	27	27	27	27	23

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1994 Near-surface measurements:													
M545.5B	Mean	1.66	0.1	0.69	0.21	0.036	2.79	44.5	3.06	22.8	8.51	11.9	23.6
	Median	1.41	0.03	0.15	0.14	0.023	2.32	43.3	2.91	22.3	8.99	11.2	24.9
	Minimum	0.63	-0.02	-0.01	0.034	-0.01	-0.05	32.6	2.17	14.3	2.14	7.53	0
	Maximum	3.63	1	3	0.98	0.21	6.64	66.5	4.29	31.1	11.2	25.1	36.6
	Std. dev.	0.789	0.23	0.927	0.198	0.049	2.198	8.331	0.585	4.112	2.064	3.681	7.648
	N obs.	26	26	26	26	26	26	26	26	26	26	26	23
M556.4A	Mean	2.26	0.1	1.44	0.18	0.035	4.17	44.4	3.01	19.1	10.1	14.1	35
	Median	2.13	0.05	1.39	0.15	0.025	4.65	45.2	2.61	18.9	10.1	12.3	32.5
	Minimum	1.7	-0.02	0.33	0.065	-0.01	0.6	-0.01	2.19	14.4	7.59	8.77	24
	Maximum	4.11	0.6	2.26	0.33	0.13	6.73	63.3	5.76	24.5	12.6	26.4	53.4
	Std. dev.	0.452	0.144	0.581	0.081	0.03	1.888	10.86	0.858	2.816	1.575	4.067	7.824
	N obs.	26	26	26	26	26	26	26	26	26	26	26	23
M563.9T	Mean	2.16	0.1	1.2	0.22	0.029	4.09	44.8	2.85	19.5	9.88	12.7	35.4
	Median	1.97	0.07	1.24	0.15	0.024	4.66	44.3	2.79	19.6	9.98	11.9	33.8
	Minimum	1.32	-0.02	0.18	0.061	-0.01	0.21	30	2.16	12.1	6.93	6.41	23.4
	Maximum	5.35	0.6	2.59	0.96	0.12	6.55	63.3	3.84	28.9	13.4	24.5	72.5
	Std. dev.	0.794	0.149	0.71	0.188	0.026	1.846	6.937	0.473	3.689	1.59	3.573	11.27
	N obs.	25	25	25	25	25	25	25	25	25	25	25	22
M574.2D	Mean	2.12	0.06	1.22	0.18	0.026	4.01	44.5	2.83	18.6	9.85	12	35.7
	Median	2.11	0.06	1.25	0.18	0.026	4.69	44.3	2.79	19	9.77	11.9	33.8
	Minimum	1.67	-0.02	0.36	0.065	-0.01	-0.05	38	2.34	14.7	7.92	9.24	22.9
	Maximum	2.81	0.1	2.14	0.3	0.056	6.26	50.4	3.63	23.3	12.3	15	53
	Std. dev.	0.324	0.034	0.562	0.064	0.017	1.875	4.266	0.333	2.554	1.25	1.099	7.769
	N obs.	19	19	19	19	19	19	19	19	19	19	19	19
M582.5B	Mean	2.31	0.07	1.49	0.18	0.031	4.5	46.2	2.79	19	9.99	13.5	35.7
	Median	2.24	0.02	1.64	0.16	0.023	4.94	45.7	2.64	18.9	10.1	11.9	34.6
	Minimum	1.59	-0.02	0.29	0.072	-0.01	0.31	38.2	1.89	14.6	7.18	9.49	25.3
	Maximum	4.25	0.5	2.41	0.37	0.11	6.71	59.6	4.47	24.3	13.5	26.4	54.4
	Std. dev.	0.533	0.12	0.632	0.088	0.028	1.692	5.054	0.528	2.545	1.705	3.484	7.494
	N obs.	26	26	26	26	26	26	26	26	26	26	26	23
MQ02.1M	Mean	5.84	0.1	5.31	0.28	0.05	4.77	68.3	2.83	28.6	7.33	14.2	26.5
	Median	5.55	-0.02	5.43	0.21	0.019	4.73	68.8	2.55	29.9	7.54	13.3	26.3
	Minimum	1.33	-0.02	1.19	0.097	-0.01	1.16	39.4	1.5	15.9	2.3	11.2	20.7
	Maximum	10.3	1.4	8.66	1.06	0.39	6.67	84.1	7.3	35.4	9.59	21.1	34.5
	Std. dev.	1.88	0.283	1.651	0.22	0.08	1.221	8.742	1.363	5.001	1.529	2.242	3.374
	N obs.	26	26	26	26	26	26	26	26	26	26	26	23

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1994 Near-surface measurements:													
PR03.2M	Mean	5.4	0.1	4.96	0.22	0.032	4.94	71.6	2.61	39.5	7.55	18.2	29.9
	Median	5.59	0.06	5.12	0.18	0.016	5.08	71.2	2.46	39.9	7.95	17.3	28.9
	Minimum	1.35	0.02	0.14	0.07	-0.01	2.44	47.3	1.38	24.9	2.79	14.5	24
	Maximum	7.91	0.6	7.78	1.27	0.26	6.44	92.2	6.24	49.4	10.2	24.7	51.5
	Std. dev.	1.219	0.132	1.877	0.229	0.053	1.178	8.911	1.005	4.942	1.649	2.949	5.321
	N obs.	26	26	26	26	26	26	26	26	26	26	26	23
RC01.7M	Mean	3.14	0.1	2.54	0.3	0.046	4.9	73.7	2.91	39.1	10.2	16.8	28.3
	Median	2.83	0.04	2.5	0.21	0.028	5.31	73.1	2.4	40.7	9.38	16.7	27
	Minimum	1.78	-0.02	0.56	0.12	-0.01	1.68	49.8	1.35	-0.01	4.42	10.1	21.2
	Maximum	8.62	0.7	4.79	2.42	0.34	6.26	90.8	8.7	49	25	25.3	47.6
	Std. dev.	1.398	0.166	1.152	0.448	0.065	1.158	8.176	1.55	9.029	3.692	3.511	6.087
	N obs.	25	26	26	25	26	26	26	26	26	26	26	23
WP02.6M	Mean	4.25	0.09	3.54	0.21	0.028	3.21	51.1	2.48	17.3	9.66	15.7	25.4
	Median	4.11	-0.02	3.71	0.16	0.014	3.69	44.5	2.4	15.9	8.88	15.6	26.1
	Minimum	0.97	-0.02	0.14	0.05	-0.01	-0.05	25.1	1.44	11.4	5.3	10.5	14.9
	Maximum	9.07	0.8	8.55	0.62	0.23	6.46	83.4	4.83	25.4	26.5	21.9	32.9
	Std. dev.	1.962	0.171	2.265	0.148	0.048	2.192	17.57	0.806	4.145	4.04	3.216	4.683
	N obs.	25	26	26	26	26	26	26	26	26	26	26	23
1994 Near-bottom measurements:													
M545.5B	Mean	1.46	0.1	0.53	0.33	0.025	3.12	43.3	3.01	21.5	8.39	9.88	24.3
	Median	1.4	0.06	0.21	0.21	0.011	2.45	43.5	3	21.4	8.82	10	21.5
	Minimum	0.94	-0.02	0.14	0.055	-0.01	0.16	34.1	2.49	18.8	5.28	7.76	13.5
	Maximum	2.02	0.2	1.32	0.98	0.076	6.6	48.6	3.45	23.8	9.95	11.8	35.9
	Std. dev.	0.386	0.085	0.541	0.331	0.027	2.496	5.355	0.333	2.073	1.609	1.684	8.777
	N obs.	6	6	6	6	6	6	6	6	6	6	6	6
1995 Near-surface measurements:													
AL02.3M	Mean	4.46	0.1	4.11	0.16	0.024	3.67	72.8	2.79	42	7	16.7	33.3
	Median	4.43	0.07	4.32	0.14	0.018	3.58	73.8	2.25	42.5	6.55	15.5	29.4
	Minimum	2.96	-0.02	2.04	0.034	-0.01	1.7	-0.01	0.99	-0.01	1.62	12.6	20.4
	Maximum	6.57	0.3	7.01	0.56	0.078	5.13	139	5.31	84.5	17.2	43.1	79.2
	Std. dev.	1.016	0.085	1.207	0.117	0.019	1.138	21.55	1.22	13.14	2.6	5.837	14.12
	N obs.	26	26	26	26	26	25	26	26	26	26	25	25

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1995 Near-surface measurements:													
M497.2B	Mean	2.97	0.08	2.19	0.15	0.038	4.45	51.1	2.97	21	11.1	15.9	40.6
	Median	2.8	0.08	2.08	0.15	0.027	4.94	51	2.7	20.1	10.5	15.4	37.5
	Minimum	1.23	0.02	0.56	0.036	-0.01	1.68	32	1.92	14.2	6.4	11.4	20.6
	Maximum	5.51	0.2	5.58	0.27	0.11	6.02	62.8	6.63	28.6	17.3	29.1	87.3
	Std. dev.	1.151	0.044	1.269	0.065	0.031	1.352	8.968	0.924	4.113	2.635	3.601	17.36
	N obs.	26	26	26	26	26	25	26	26	26	26	25	25
M508.1F	Mean	4.81	0.3	3.85	0.17	0.033	3.83	54.7	2.67	28.1	11.3	18	34.9
	Median	2.96	0.09	2.85	0.15	-0.01	3.76	53	2.52	26.4	11	17.3	34
	Minimum	-0.1	-0.02	0.21	0.03	-0.01	0.27	31.5	1.23	14.8	8.14	11.4	24.4
	Maximum	19.3	1.5	14.2	0.4	0.17	8.59	94.8	7.23	44.3	16	25.6	47.7
	Std. dev.	4.383	0.473	3.721	0.095	0.047	2.365	16.56	1.138	8.189	2.03	3.536	6.839
	N obs.	26	26	26	26	26	25	26	26	26	26	25	25
M511.4B	Mean	2.52	0.09	1.83	0.16	0.044	4.58	48.3	2.98	21	12.1	16.7	41
	Median	2.49	0.09	1.83	0.16	0.032	4.9	47.4	2.67	19.8	11.6	15.9	38.5
	Minimum	1.33	-0.02	0.57	0.042	-0.01	1.09	30.1	1.77	13.6	7.4	11.9	19.7
	Maximum	3.75	0.2	4.44	0.29	0.12	8.53	64.1	7.02	29.9	17.3	28.9	72.6
	Std. dev.	0.631	0.042	0.9	0.062	0.033	1.817	9.335	1.022	4.272	2.604	3.391	15.69
	N obs.	26	26	26	26	26	25	26	26	26	26	25	25
M525.5L	Mean	2.38	0.06	1.55	0.16	0.034	4.56	48.8	3	21.3	10.5	13.3	38
	Median	2.47	0.05	1.55	0.14	0.019	5.25	50.3	2.55	20.9	10.4	13.1	33.3
	Minimum	1.3	-0.02	0.53	0.034	-0.01	0.89	31.4	1.98	13.3	5.61	9.99	18.6
	Maximum	3.5	0.2	3.27	0.54	0.085	6.24	63.2	7.47	29.6	15.9	16.8	65.1
	Std. dev.	0.576	0.036	0.639	0.108	0.026	1.671	8.767	1.099	4.827	2.559	1.837	14.97
	N obs.	24	24	24	24	24	23	24	24	24	24	23	23
M532.3T	Mean	2.51	0.07	1.64	0.14	0.03	4.4	51.7	3.07	24.1	10.1	14.6	39.9
	Median	2.48	0.05	1.59	0.14	0.02	4.72	52.8	2.73	24.6	9.68	12.9	36.5
	Minimum	1.37	-0.02	0.26	0.015	-0.01	1.32	30.5	1.68	13.4	5.97	10.3	19.4
	Maximum	3.55	0.3	3.09	0.34	0.096	6.76	71.7	7.95	36.6	15.8	22.5	88.1
	Std. dev.	0.639	0.065	0.832	0.084	0.024	1.66	10.78	1.25	6.146	2.507	3.381	17.21
	N obs.	26	25	25	26	26	25	26	26	26	26	25	25
M540.2T	Mean	2.26	0.07	1.44	0.15	0.036	4.47	50.1	2.96	22.4	10	13.1	35.4
	Median	2.26	0.05	1.46	0.13	0.025	4.85	49.5	2.58	22.7	9.75	13.3	30.2
	Minimum	1.25	-0.02	0.03	0.025	-0.01	1.4	31.1	1.83	13.6	5.69	1.33	0
	Maximum	3.21	0.4	2.77	0.3	0.12	6.94	62.2	7.56	30	14.9	16	54.4
	Std. dev.	0.514	0.074	0.695	0.085	0.031	1.707	9.272	1.128	4.848	2.166	2.863	14.56
	N obs.	26	26	26	26	26	25	26	26	26	26	25	25

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1995 Near-surface measurements:													
M545.5B	Mean	1.93	0.08	0.73	0.18	0.022	3.46	48.9	3.14	25.5	9.62	12.7	24.2
	Median	1.61	0.04	0.066	0.14	-0.01	3.18	48.6	3.06	25	9.37	12.1	23.3
	Minimum	1.2	-0.02	-0.01	0.033	-0.01	-0.05	24.9	2.22	15.8	5.65	10.2	15.5
	Maximum	3.75	0.4	3.43	0.47	0.17	8.83	75	7.59	46.3	13.4	16.4	47.8
	Std. dev.	0.783	0.098	1.141	0.121	0.036	2.833	12.68	1.054	6.423	2.061	2.069	7.153
	N obs.	25	25	25	25	25	23	25	25	25	25	23	23
M556.4A	Mean	2.29	0.09	1.53	0.14	0.039	4.62	48.5	3.02	20.8	10.7	14.1	39.3
	Median	2.44	0.08	1.58	0.13	0.028	5.31	45.9	2.7	19.4	9.94	13.8	41.1
	Minimum	1.24	-0.02	0.48	0.036	-0.01	0.97	30.3	1.47	12.9	6.34	9.73	17.2
	Maximum	3.68	0.3	3.13	0.3	0.097	6.42	61.5	7.35	28.5	14.8	18.5	65.3
	Std. dev.	0.576	0.057	0.608	0.058	0.027	1.675	9.266	1.175	4.564	2.626	2.397	14.95
	N obs.	26	26	26	26	26	25	26	26	26	26	25	25
M563.9T	Mean	2.22	0.08	1.33	0.14	0.033	4.41	48.7	3.08	21.3	10.6	14.5	44.2
	Median	2.24	0.07	1.42	0.14	0.028	4.92	46	2.85	20	10.3	13.7	43
	Minimum	1.33	-0.02	0.42	0.018	-0.01	0.88	31.9	1.89	13.6	5.75	10.1	17.7
	Maximum	3.57	0.4	2.32	0.31	0.088	6.72	66.7	7.65	31	15.1	30.1	95.4
	Std. dev.	0.546	0.072	0.59	0.079	0.025	1.633	10.54	1.221	5.222	2.56	3.851	19.61
	N obs.	25	25	25	25	25	24	25	25	25	25	24	24
M574.2D	Mean	2.37	0.1	1.49	0.17	0.05	4.4	47	3.19	20	9.74	12.6	41
	Median	2.57	0.1	1.56	0.17	0.049	4.88	45.4	3.06	18.9	9.65	12.8	47.3
	Minimum	1.38	0.05	0.5	0.083	-0.01	1.07	30.6	1.98	13.1	5.9	-0.01	0
	Maximum	3.67	0.3	3.07	0.32	0.11	6.6	61.8	6.27	28.5	15.4	20.7	63.1
	Std. dev.	0.65	0.06	0.692	0.058	0.03	1.742	9.62	1.055	4.853	2.538	3.884	18.42
	N obs.	19	19	19	19	19	18	19	19	19	19	18	18
M582.5B	Mean	2.44	0.07	1.65	0.13	0.035	4.73	49.7	2.96	21	10.4	14.5	43.3
	Median	2.47	0.06	1.83	0.13	0.023	5.36	48.4	2.58	20.1	10.2	14.5	45.9
	Minimum	1.25	-0.02	0.5	0.051	-0.01	1.21	30.9	1.77	13.4	6.04	9.49	18.7
	Maximum	3.91	0.3	3.24	0.2	0.093	6.75	66.1	7.05	29.6	16.5	21.7	85.3
	Std. dev.	0.638	0.056	0.666	0.049	0.025	1.686	9.889	1.134	4.7	2.666	2.863	17.07
	N obs.	26	26	26	26	26	25	26	26	26	26	25	25
MQ02.1M	Mean	6.82	0.08	5.9	0.4	0.036	5.15	74.3	2.99	31.5	7.67	16.1	31.3
	Median	6.23	0.04	5.98	0.17	0.019	5.03	75.3	2.55	30.4	7.13	15.2	27
	Minimum	1.91	-0.02	2.1	0.045	-0.01	2.1	37.2	1.23	17.5	5.24	12.2	20.7
	Maximum	18.8	0.5	10	4.65	0.13	6.38	97.7	5.94	41.3	11.6	31.6	80.1
	Std. dev.	2.958	0.106	1.655	0.882	0.031	0.95	12.39	1.259	6.197	1.556	3.941	13.73
	N obs.	26	26	26	26	26	24	26	26	26	26	24	24

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1995 Near-surface measurements:													
PR03.2M	Mean	6.72	0.1	5.9	0.16	0.025	5.14	77.3	2.86	42.8	7.9	20.6	32.5
	Median	6.62	0.08	6.06	0.16	0.015	5.34	79.3	2.4	42.9	7.67	19.2	28.8
	Minimum	3.94	-0.02	1.74	0.027	-0.01	2.4	37.6	1.44	17.4	5.64	11.3	16.6
	Maximum	8.88	0.4	7.18	0.48	0.16	6.92	95.9	6.81	53.2	10.9	48.5	83.9
	Std. dev.	1.175	0.079	1.082	0.103	0.031	1.083	11.47	1.303	7.087	1.615	6.955	14
	N obs.	26	26	26	26	26	24	26	26	26	26	24	24
RC01.7M	Mean	3.38	0.09	2.89	0.24	0.038	4.97	76.5	3.19	42.7	9.93	20.7	31.4
	Median	3.2	0.06	2.68	0.19	0.031	5.19	78.7	2.88	43.7	9.89	18.1	27.7
	Minimum	1.76	-0.02	1.12	0.081	-0.01	3.27	8.39	1.65	4.3	0.61	12.8	20.3
	Maximum	5.48	0.4	4.53	0.63	0.16	6.18	107	6.21	59.9	15.1	85.9	82.3
	Std. dev.	0.94	0.081	1.054	0.153	0.03	0.767	19.16	1.246	11.23	3.003	13.93	15.59
	N obs.	26	26	26	26	26	25	26	26	26	26	25	25
WP02.6M	Mean	5.34	0.06	4.47	0.16	0.016	3.26	60.7	2.42	21.7	9.16	20	32
	Median	5.09	0.05	5.06	0.13	0.011	4.17	63.2	2.01	21.1	9.22	18.7	27.5
	Minimum	1.7	-0.02	0.072	0.032	-0.01	-0.05	31	1.26	11.9	5.48	14.5	20.2
	Maximum	10.8	0.2	10.3	0.47	0.062	5.84	94	6.69	45.3	15.2	53	83.3
	Std. dev.	2.607	0.049	3.023	0.105	0.015	2.104	17.22	1.153	6.279	2.601	7.534	14.59
	N obs.	26	26	26	26	26	25	26	26	26	26	25	25
1995 Near-bottom measurements:													
M545.5B	Mean	1.91	0.2	0.57	0.21	0.028	2.76	49	3.12	26.3	9.27	11.3	20.3
	Median	1.66	0.2	0.089	0.2	0.014	2.04	45.4	3.21	27.3	9.44	10.7	17.6
	Minimum	1.51	-0.02	-0.01	0.041	-0.01	-0.05	35.7	2.31	20.9	7.15	9.86	15.4
	Maximum	2.99	0.4	2.13	0.33	0.11	6.04	69	3.75	30.7	12	14.3	26.2
	Std. dev.	0.514	0.183	0.893	0.108	0.039	2.159	11.08	0.553	3.749	1.752	1.582	4.475
	N obs.	7	7	7	7	7	6	7	7	7	7	6	6
1996 Near-surface measurements:													
AL02.3M	Mean	3.8	0.2	3.47	0.27	0.046	3.23	71.1	3.63	40.5	5.98	16.6	24.1
	Median	2.7	0.07	2.72	0.14	0.01	3.41	72.9	3.06	42	5.88	15.9	22.5
	Minimum	1.32	-0.02	0.088	0.049	-0.01	-0.05	38.3	1.44	22.9	3.36	12.4	18.9
	Maximum	8.15	1.7	7.3	0.85	0.57	5.02	94	15.6	49.9	8.1	24.6	41.4
	Std. dev.	1.913	0.42	1.982	0.257	0.116	1.164	14.62	2.648	7.665	1.234	2.638	4.935
	N obs.	24	19	24	16	24	23	24	24	24	24	23	23

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1996 Near-surface measurements:													
M497.2B	Mean	2.73	0.2	2.07	0.18	0.047	3.86	42.6	3.45	16.9	8.97	16.4	26.7
	Median	2.78	0.1	1.93	0.16	0.039	3.95	39.3	3.42	17	9.15	15.7	24.3
	Minimum	0.84	0.06	0.19	0.064	-0.01	0.66	18.3	2.49	8.62	5.13	11	14.8
	Maximum	6.38	0.4	7.94	0.62	0.14	6.91	67.8	4.92	26.6	12.9	26.1	48
	Std. dev.	1.495	0.116	1.729	0.127	0.03	1.755	10.49	0.67	3.804	2.108	3.779	9.009
	N obs.	25	20	25	17	25	24	25	25	25	25	24	24
M508.1F	Mean	3.31	0.6	3.32	0.24	0.05	2.8	43.1	3.46	21.9	9.16	18.4	26.3
	Median	2.86	0.06	1.56	0.18	0.015	2.98	39.7	3.39	22.3	9.23	18	25
	Minimum	0.85	-0.02	0.13	0.047	-0.01	-0.05	20.2	1.47	8.03	4.77	9.51	1.24
	Maximum	10.3	4.5	13.6	0.79	0.51	6.16	86.2	5.64	47	14.7	26	48.6
	Std. dev.	1.96	1.124	3.859	0.2	0.108	1.939	14.31	0.879	7.893	2.642	4.373	9.25
	N obs.	25	20	25	17	25	24	25	25	25	25	24	24
M511.4B	Mean	2.24	0.2	1.38	0.24	0.053	3.92	40.5	3.41	16.9	10.4	17.3	26.2
	Median	2.51	0.1	1.4	0.15	0.047	4.31	39	3.48	16.8	11.1	17.9	21.9
	Minimum	0.95	0.07	0.22	0.085	-0.01	0.85	18.2	1.95	8.46	6.22	11.3	0.87
	Maximum	4.09	0.4	2.59	1.17	0.11	6.68	61	5.37	24.8	14	22.3	50.4
	Std. dev.	0.888	0.104	0.802	0.256	0.029	1.877	9.95	0.729	4.05	2.35	2.658	10.61
	N obs.	25	20	25	17	25	24	25	25	25	25	24	24
M525.5L	Mean	1.86	0.1	1.03	0.18	0.041	3.41	38.5	3.3	16	7.89	12.8	24.6
	Median	1.75	0.08	0.99	0.14	0.044	3.1	37.9	3.03	16.4	7.76	13.7	20.7
	Minimum	0.97	-0.02	0.12	0.08	-0.01	0.47	18.2	2.16	8.26	4.24	1.02	2.01
	Maximum	3.29	0.4	2.28	0.38	0.079	6.69	57.6	4.77	22.2	11.7	16	39.4
	Std. dev.	0.737	0.117	0.709	0.098	0.021	1.915	8.96	0.743	3.696	1.948	3.396	9.459
	N obs.	21	16	21	14	21	20	21	21	21	21	20	20
M532.3T	Mean	2.09	0.09	1.35	0.18	0.037	3.99	41.9	3.43	18.7	7.61	13.8	23.5
	Median	2.14	0.04	1.32	0.13	0.034	4.29	41.7	3.27	19.3	7.79	15	21.6
	Minimum	0.76	-0.02	-0.01	0.067	-0.01	0.15	25.6	2.25	9.09	4.63	-0.01	-0
	Maximum	3.96	0.4	3.18	0.54	0.091	7.12	59.6	5.13	29	12.1	19	38.1
	Std. dev.	0.984	0.111	0.929	0.124	0.022	1.706	8.672	0.725	4.857	1.916	3.966	8.106
	N obs.	22	17	22	14	22	21	22	22	22	22	21	21
M540.2T	Mean	1.98	0.1	1.3	0.24	0.039	3.74	40.7	3.38	17.7	8.03	13.7	25.3
	Median	2.1	0.1	1.31	0.14	0.035	3.58	40.1	3.3	17.7	8.14	13.4	22.4
	Minimum	0.65	-0.02	0.095	0.058	-0.01	0.59	18.9	2.07	8.56	4.1	8.84	16.8
	Maximum	3.75	0.6	5.47	1.61	0.15	5.95	59.9	4.89	26.4	10.9	22	41.8
	Std. dev.	0.872	0.143	1.133	0.371	0.029	1.595	9.877	0.722	4.761	1.908	2.733	7.698
	N obs.	24	19	24	16	24	22	24	24	24	24	22	22

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1996 Near-surface measurements:													
M545.5B	Mean	1.64	0.1	0.45	0.14	0.019	2.49	40.2	3.67	20.5	6.69	10.8	18.2
	Median	1.49	0.03	0.041	0.13	-0.01	1.65	43.6	3.51	20.5	6.07	11	16.3
	Minimum	0.73	-0.02	-0.01	0.049	-0.01	-0.05	12.8	2.07	5.36	3.06	-0.01	-0
	Maximum	3.44	0.5	2.42	0.29	0.11	6.47	62.8	4.89	29.9	11.6	17.7	46.1
	Std. dev.	0.705	0.138	0.786	0.068	0.026	2.327	11.71	0.712	6.642	2.213	3.815	9.889
	N obs.	24	19	24	17	24	22	24	24	24	24	22	22
M556.4A	Mean	1.9	0.2	1.05	0.18	0.045	3.78	38.9	3.29	16.1	8.13	14.1	26.8
	Median	1.98	0.1	0.89	0.11	0.046	3.83	36.7	3.12	15.6	7.68	14	22.1
	Minimum	0.7	0.06	-0.01	0.067	-0.01	0.44	17.2	2.25	7.32	4.27	8.76	15.5
	Maximum	3.27	0.4	2.07	0.75	0.093	6.67	58.2	4.83	25	11.6	26.5	50
	Std. dev.	0.82	0.105	0.72	0.174	0.027	2.087	8.746	0.63	3.807	2.016	3.313	9.945
	N obs.	24	19	24	16	24	23	24	24	24	24	23	23
M563.9T	Mean	1.81	0.1	0.87	0.17	0.036	3.17	39.4	3.35	16.7	8.01	14	26.4
	Median	1.69	0.1	0.73	0.12	0.032	3.08	39.4	3.27	16.7	8.2	13.7	25.3
	Minimum	0.79	-0.02	-0.01	0.06	-0.01	0.5	18.1	2.28	7.62	4.18	8.72	15.4
	Maximum	3.66	0.5	2.6	0.79	0.13	5.56	57.4	5.16	23.9	12.3	18.1	45.5
	Std. dev.	0.732	0.115	0.662	0.182	0.033	1.634	9.426	0.7	4.476	1.959	2.352	8.29
	N obs.	21	16	21	14	21	20	21	21	21	21	20	20
M582.5B	Mean	2	0.2	1.28	0.15	0.043	3.94	40.5	3.34	16.5	8.11	14.9	27.6
	Median	2.08	0.1	1.4	0.12	0.043	4.3	38.8	3.24	16.1	7.93	14.5	23.5
	Minimum	0.8	0.04	-0.01	0.064	-0.01	0.37	18.1	2.34	7.92	4.37	9.07	15.6
	Maximum	3.71	0.8	3.53	0.5	0.13	6.84	58.8	5.4	25	12.8	25.6	52
	Std. dev.	0.961	0.182	0.925	0.1	0.029	2.083	9.463	0.707	4.005	2.147	3.79	10.76
	N obs.	25	20	25	17	25	24	25	25	25	25	24	24
MQ02.1M	Mean	6.35	0.2	5.19	0.51	0.07	4.49	67.4	4.04	27.8	6.76	16.6	23.8
	Median	5.01	0.02	4.52	0.23	0.032	4.44	72.8	3.15	29.7	6.89	15.8	23.2
	Minimum	0.71	-0.02	-0.01	0.068	-0.01	0.67	-0.01	1.71	-0.01	-0.01	10.7	11.7
	Maximum	13.3	1.7	12.3	3.25	0.69	6.98	93.8	11.1	44.1	16	23	37.1
	Std. dev.	3.206	0.488	3.009	0.795	0.141	1.377	21.81	1.999	9.758	2.732	3.014	5.667
	N obs.	25	20	25	18	25	24	25	25	25	25	24	24
PR03.2M	Mean	7.02	0.2	6.05	0.38	0.052	4.05	74.2	3.62	40.5	7.06	21.8	24.8
	Median	7.02	0.07	6.43	0.14	0.015	4.35	76.3	3.12	42.5	6.92	21.1	24.7
	Minimum	4.22	-0.02	1.95	0.032	-0.01	2.03	25.2	1.89	14	3.22	12.9	12.8
	Maximum	12.5	2	8.33	3.26	0.71	6.28	94.1	10.3	52.3	15.2	37.9	45.8
	Std. dev.	1.755	0.433	1.686	0.774	0.139	1.151	16.64	1.78	9.141	2.221	5.787	6.402
	N obs.	25	20	25	17	25	24	25	25	25	25	24	24

Table E-2. Continued.

Sampling location	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1996 Near-surface measurements:													
RC01.7M	Mean	3.35	0.4	2.35	0.75	0.09	4.05	72.2	4.2	39.5	10	19.9	23
	Median	2.33	0.06	1.91	0.19	0.028	4.35	73.3	3.48	41.9	10.2	18.5	21.9
	Minimum	0.98	-0.02	0.5	0.08	-0.01	0.16	16.1	1.5	9.04	4.58	13.7	9.55
	Maximum	9.19	4.4	5.48	4.72	1.17	5.82	101	13.4	52.6	17.4	29.8	42.8
	Std. dev.	2.249	0.987	1.499	1.412	0.235	1.307	18.69	2.45	10.1	3.787	4.198	5.958
	N obs.	25	20	25	18	25	24	25	25	25	25	24	24
RK00.1M	Mean	15.9	2.4	11.6	0.11	0.032	4.94	73.2	2.83	32.4	8.05	21.9	33
	Median	15.2	2.4	12.9	0.093	-0.01	4.84	73.1	2.34	33.2	8.04	23	34.7
	Minimum	11.7	0.4	-0.01	0.023	-0.01	3.21	36.1	2.01	15	5.01	0.056	2
	Maximum	21.2	5.9	15.4	0.2	0.3	6.7	97.7	6.06	44.4	12	33.1	44.4
	Std. dev.	2.639	1.409	4.703	0.065	0.075	0.948	17.24	1.169	8.291	1.776	6.922	9.484
	N obs.	15	14	15	8	15	15	15	15	15	15	15	15
RK03.7M	Mean	7.45	0.07	6.56	0.1	0.016	4.94	73.3	2.02	30.5	7.37	21.7	35.3
	Median	6.68	0.06	6.35	0.068	-0.01	4.82	75.6	1.74	32.8	6.69	20.5	35.9
	Minimum	5.15	-0.02	1.99	0.016	-0.01	2.95	40.7	1.23	18.4	4.21	19.1	22.6
	Maximum	11.3	0.2	11.3	0.27	0.071	6.03	92.6	4.95	37.3	18.3	39.1	54.8
	Std. dev.	1.972	0.052	2.465	0.082	0.02	0.95	15.55	0.907	5.578	3.414	4.912	6.499
	N obs.	15	14	15	8	15	15	15	15	15	15	15	15
WP02.6M	Mean	5.8	0.2	3.66	0.65	0.059	2.73	49.4	3.89	16.6	8.34	19.2	22.6
	Median	5.19	0.03	2.71	0.25	0.016	2.6	42.7	3.12	17.8	7.85	19.1	22.2
	Minimum	1.7	-0.02	0.076	0.049	-0.01	-0.05	15.9	1.14	9.38	4.64	10.2	9.68
	Maximum	13.1	1.4	11.5	3.5	0.77	5.71	90.2	10.4	28	23.9	28.2	34
	Std. dev.	3.335	0.335	2.991	0.969	0.158	1.835	21.47	2.097	5.02	3.663	5.103	5.869
	N obs.	25	20	25	19	25	24	25	25	25	25	24	24
1996 Near-bottom measurements:													
M508.1F	Mean	3.54	0.5	1.96	0.11	0.03	4.28	43.3	3.38	20.3	7.17	17.5	28.9
	Median	2.85	0.3	0.66	0.097	0.034	4.03	40.9	3.39	19.2	5.74	17.7	27.6
	Minimum	1.76	0.1	0.28	0.097	-0.01	1.73	25.2	2.43	14.6	5.47	13.9	25
	Maximum	6.16	0.9	4.62	0.13	0.047	6.28	61	4.26	24.6	9.8	20.6	35.1
	Std. dev.	1.836	0.368	1.765	0.022	0.016	1.684	13.48	0.702	4.392	1.804	2.869	3.888
	N obs.	6	6	6	2	6	6	6	6	6	6	6	6

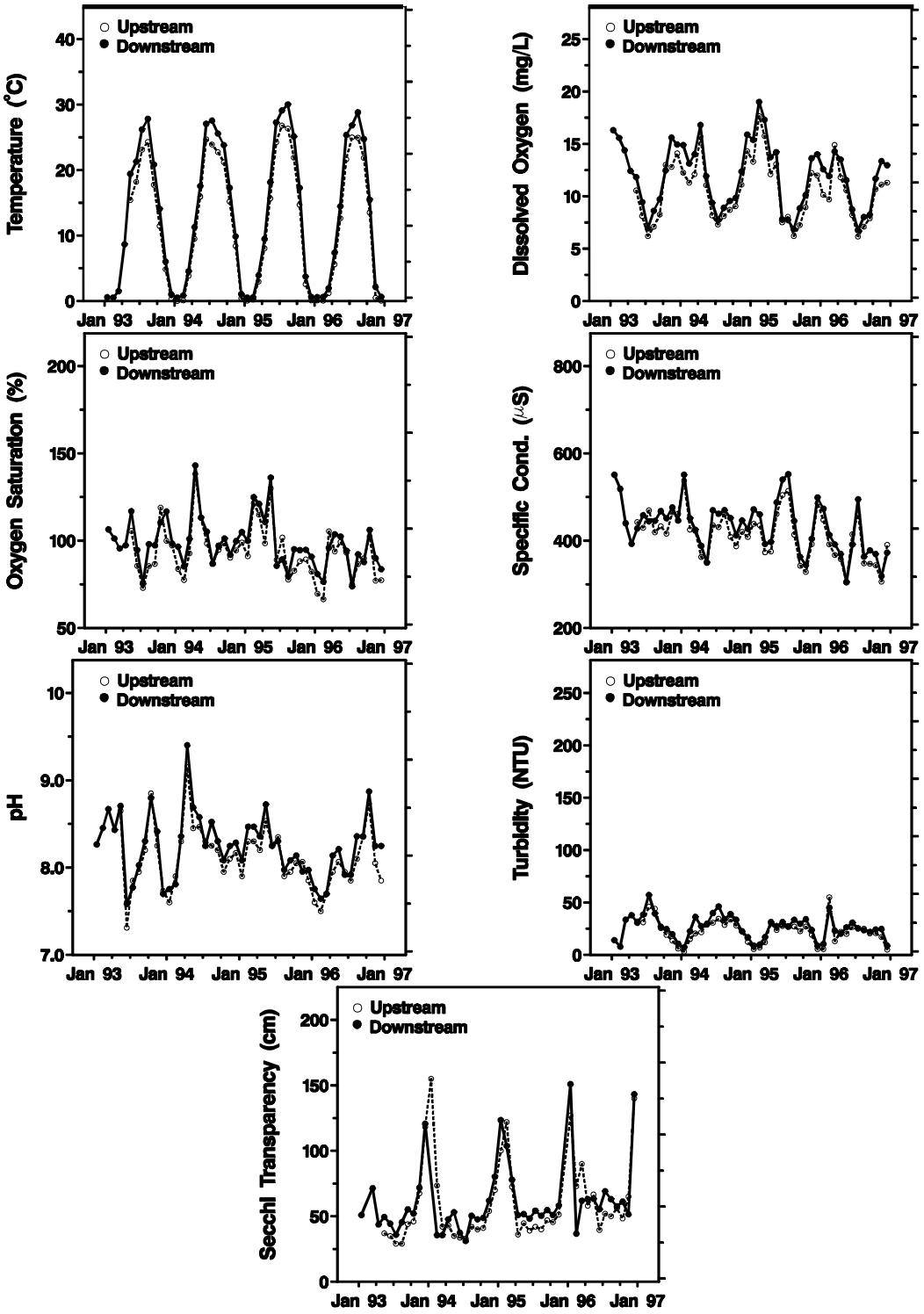

Figure E-1a. Monthly means of temperature (°C), dissolved oxygen (mg/L), oxygen saturation (%), pH, specific conductivity (µS), turbidity (NTU), and Secchi transparency (cm) in upper and lower Pool 12 from 1993 through 1996.

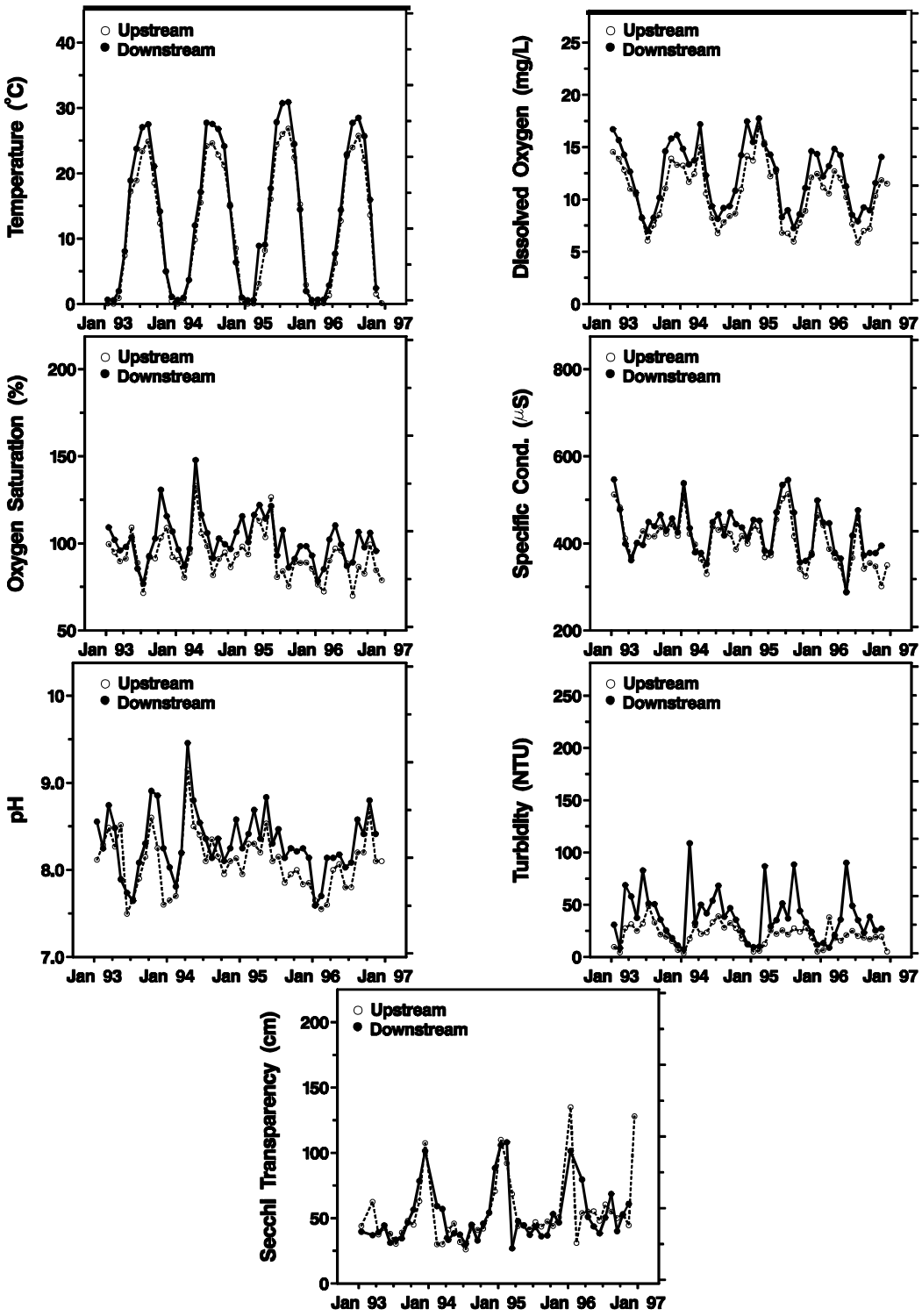

Figure E-1b. Monthly means of temperature (°C), dissolved oxygen (mg/L), oxygen saturation (%), pH, specific conductivity (µS), and turbidity (NTU) in upper and lower Pool 13 from 1993 through 1996.

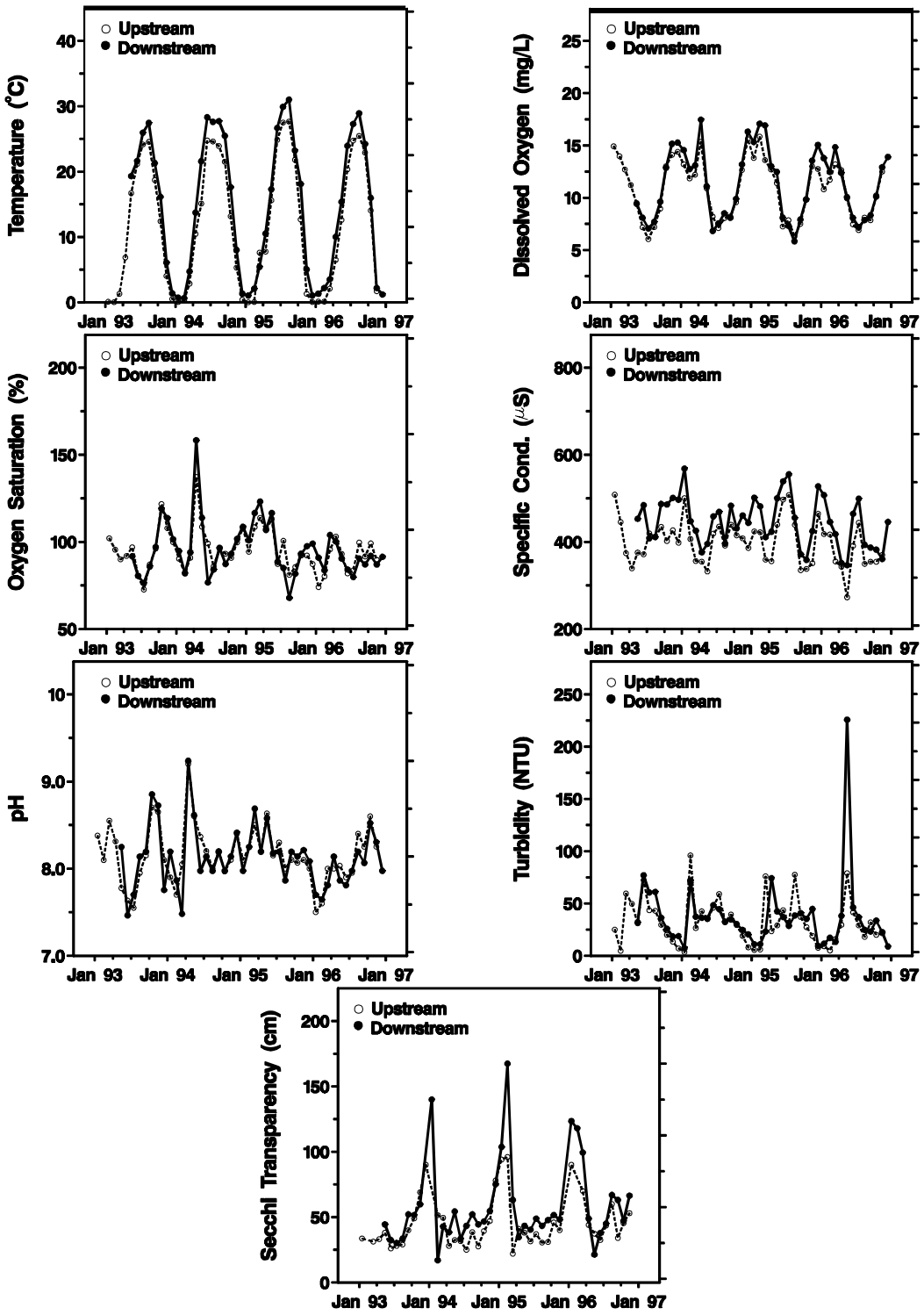

Figure E-1c. Monthly means of temperature (°C), dissolved oxygen (mg/L), oxygen saturation (%), pH, specific conductivity (µS), and turbidity (NTU) in upper and lower Pool 14 from 1993 through 1996.

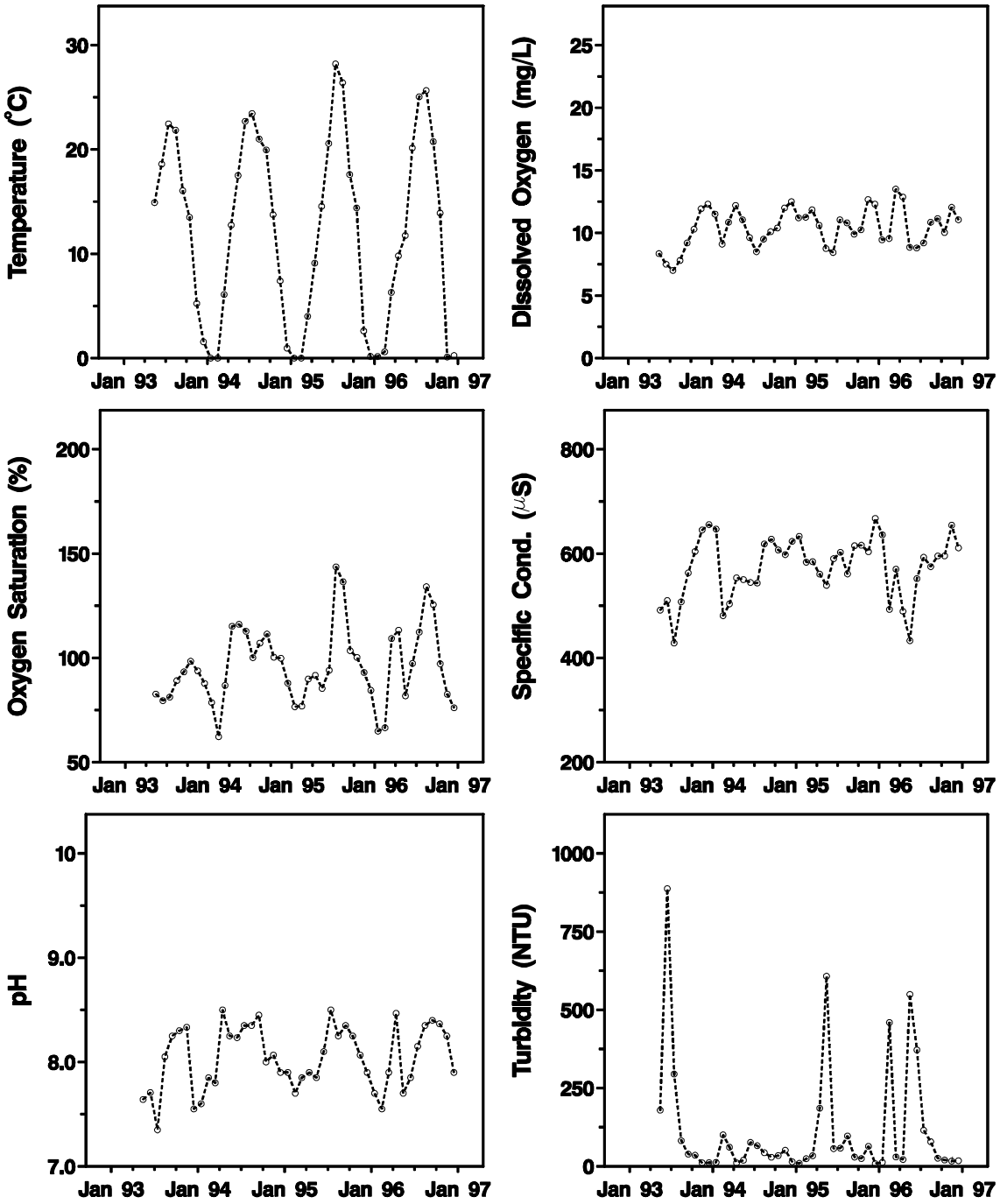

Figure E-1d. Monthly means of temperature (°C), dissolved oxygen (mg/L), oxygen saturation (%), pH, specific conductivity (µS), and turbidity (NTU) in the Maquoketa River from 1993 through 1996.

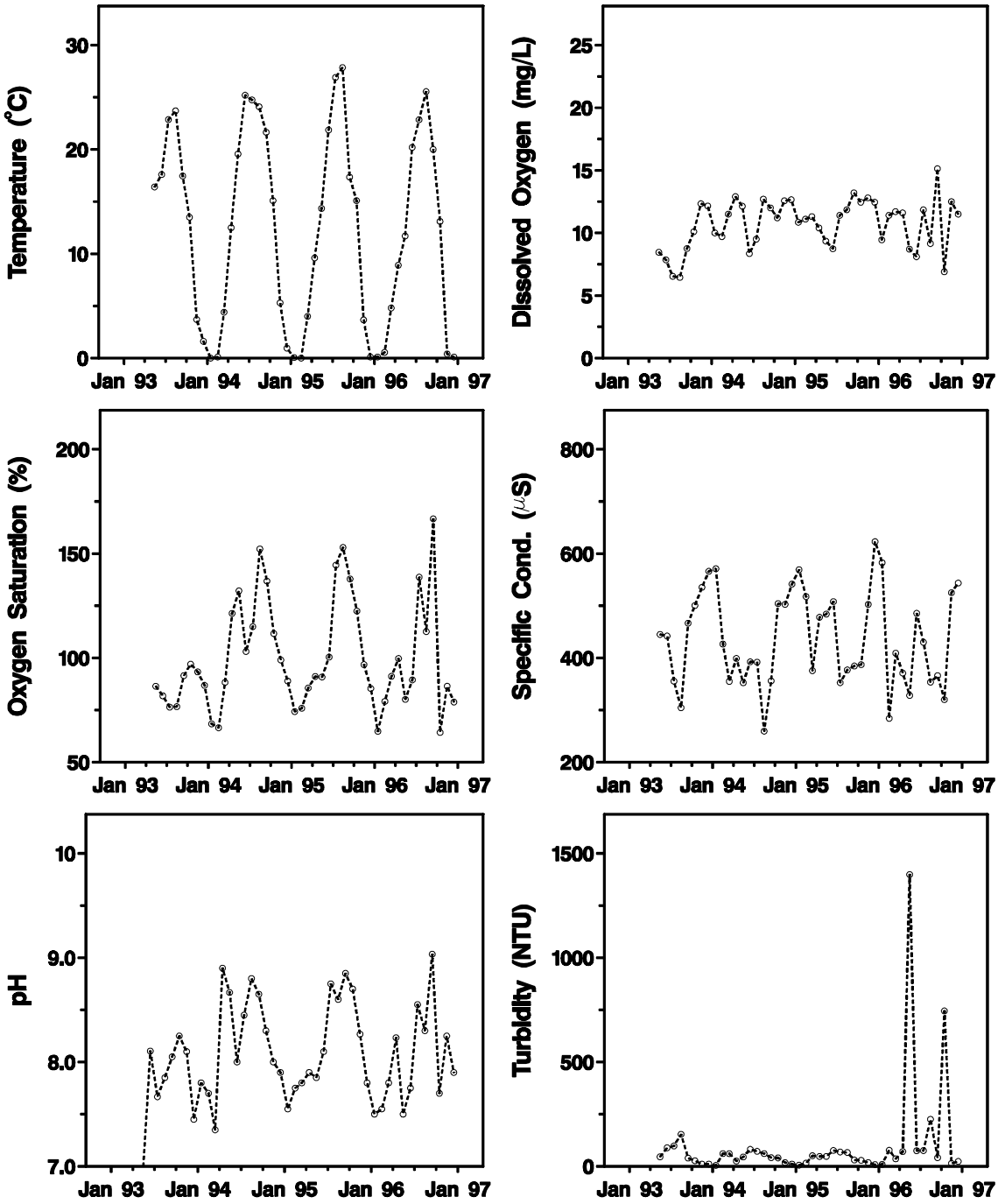

Figure E-1e. Monthly means of temperature (°C), dissolved oxygen (mg/L), oxygen saturation (%), pH, specific conductivity (µS), and turbidity (NTU) in the Wapsipinicon River from 1993 through 1996.

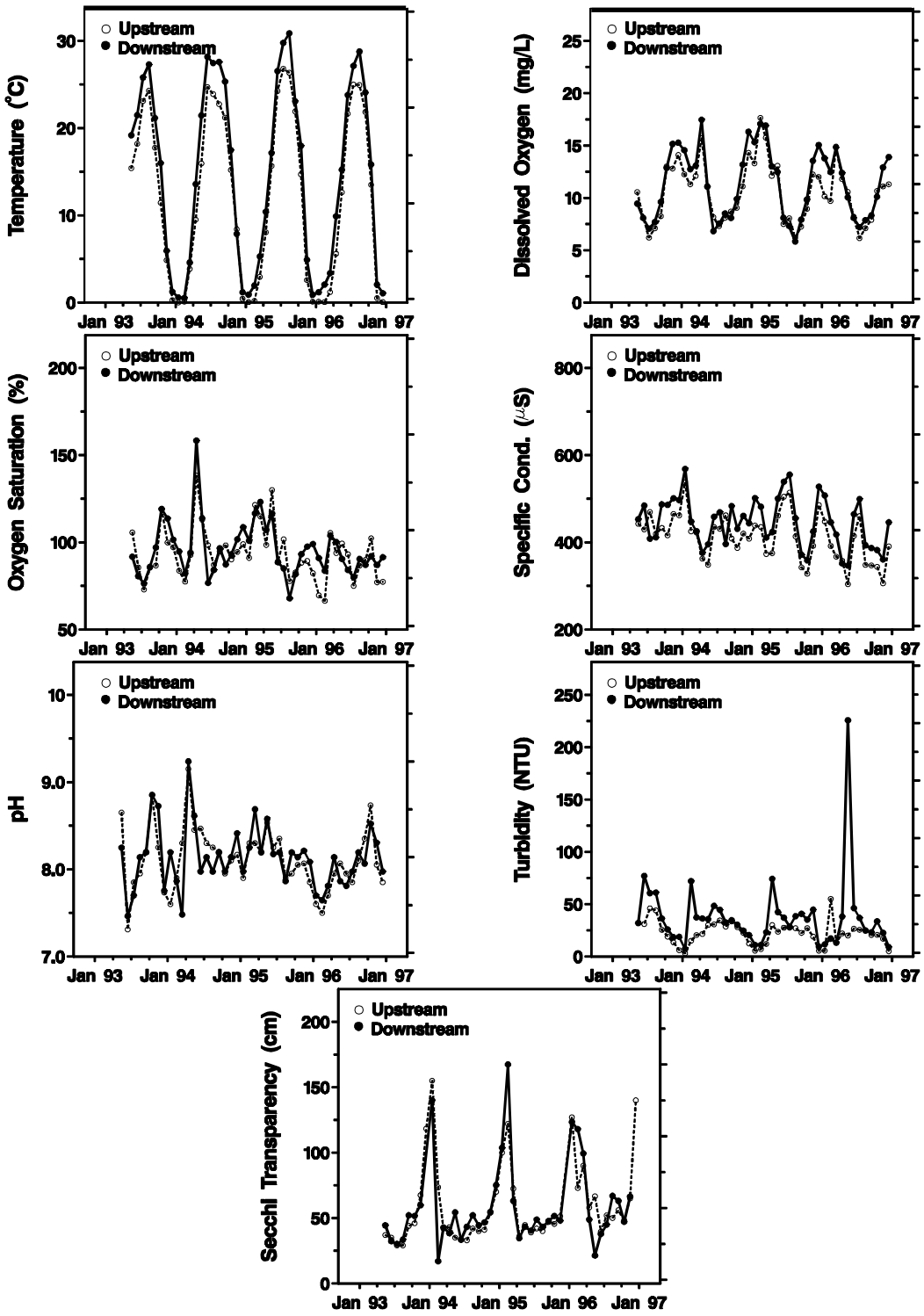

Figure E-1f. Monthly means of temperature (°C), dissolved oxygen (mg/L), oxygen saturation (%), pH, specific conductivity (µS), and turbidity (NTU) in upper Pool 12 (upstream) and lower Pool 14 (downstream) from 1993 through 1996.

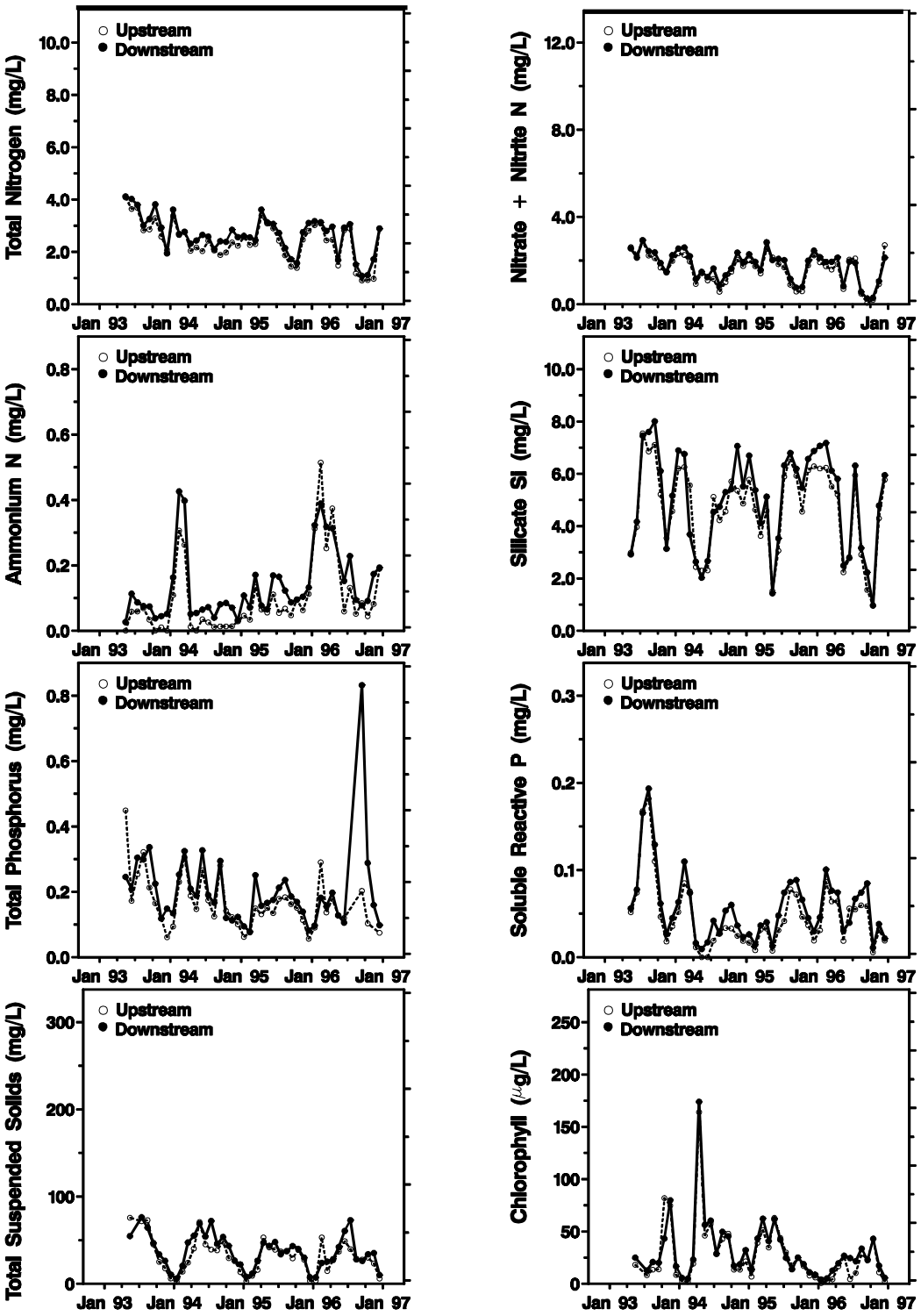

Figure E-2a. Monthly means of total nitrogen (mg/L), nitrate–nitrite nitrogen (mg/L), ammonium nitrogen (mg/L), silicate silicon (mg/L), total phosphorus (mg/L), soluble reactive phosphorus (mg/L), total suspended solids (mg/L), and chlorophyll *a* (µg/L) in upper and lower Pool 12 from 1993 through 1996.

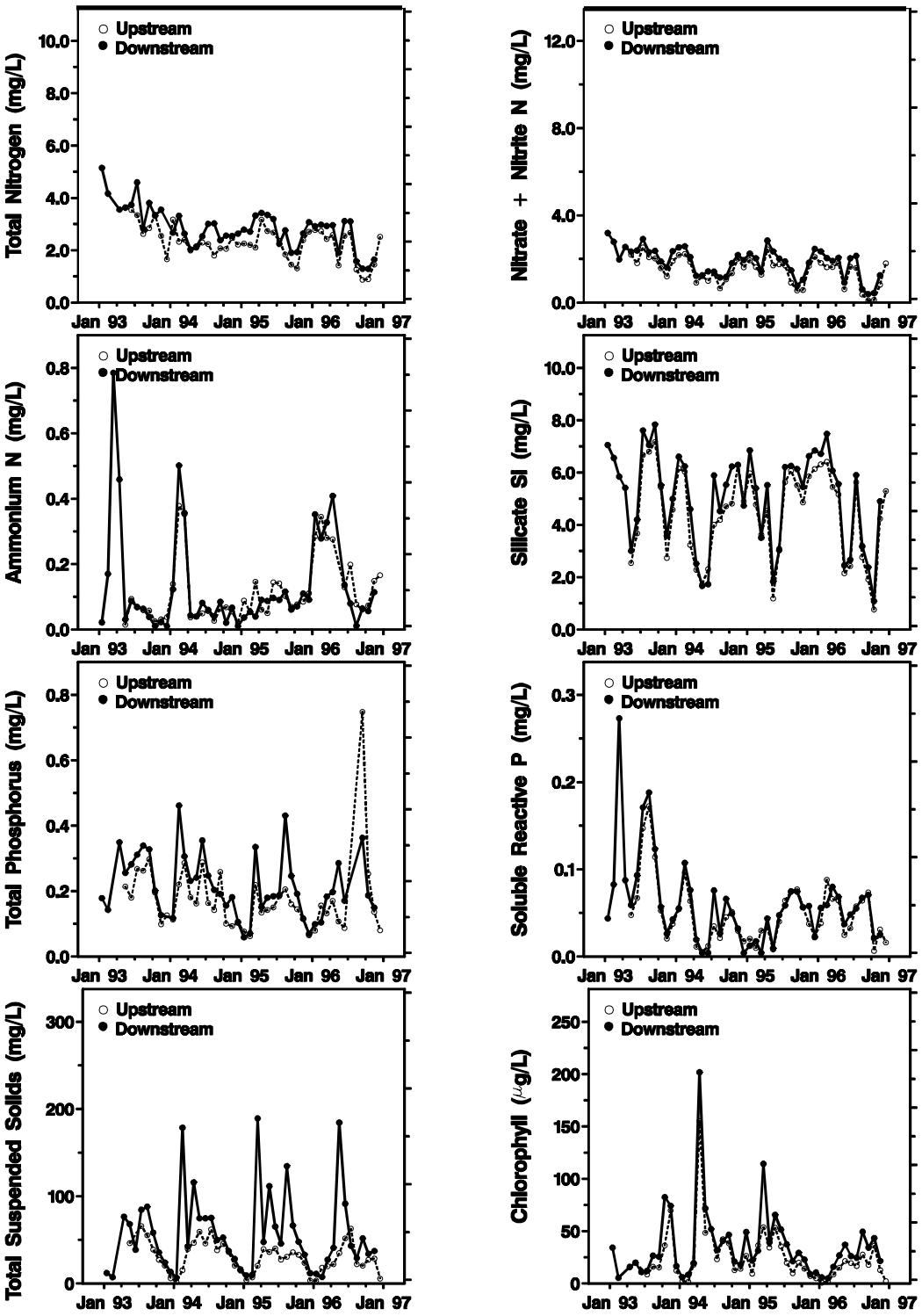

Figure E-2b. Monthly means of total nitrogen (mg/L), nitrate–nitrite nitrogen (mg/L), ammonium nitrogen (mg/L), silicate silicon (mg/L), total phosphorus (mg/L), soluble reactive phosphorus (mg/L), total suspended solids (mg/L), and chlorophyll *a* (µg/L) in upper and lower Pool 13 from 1993 through 1996.

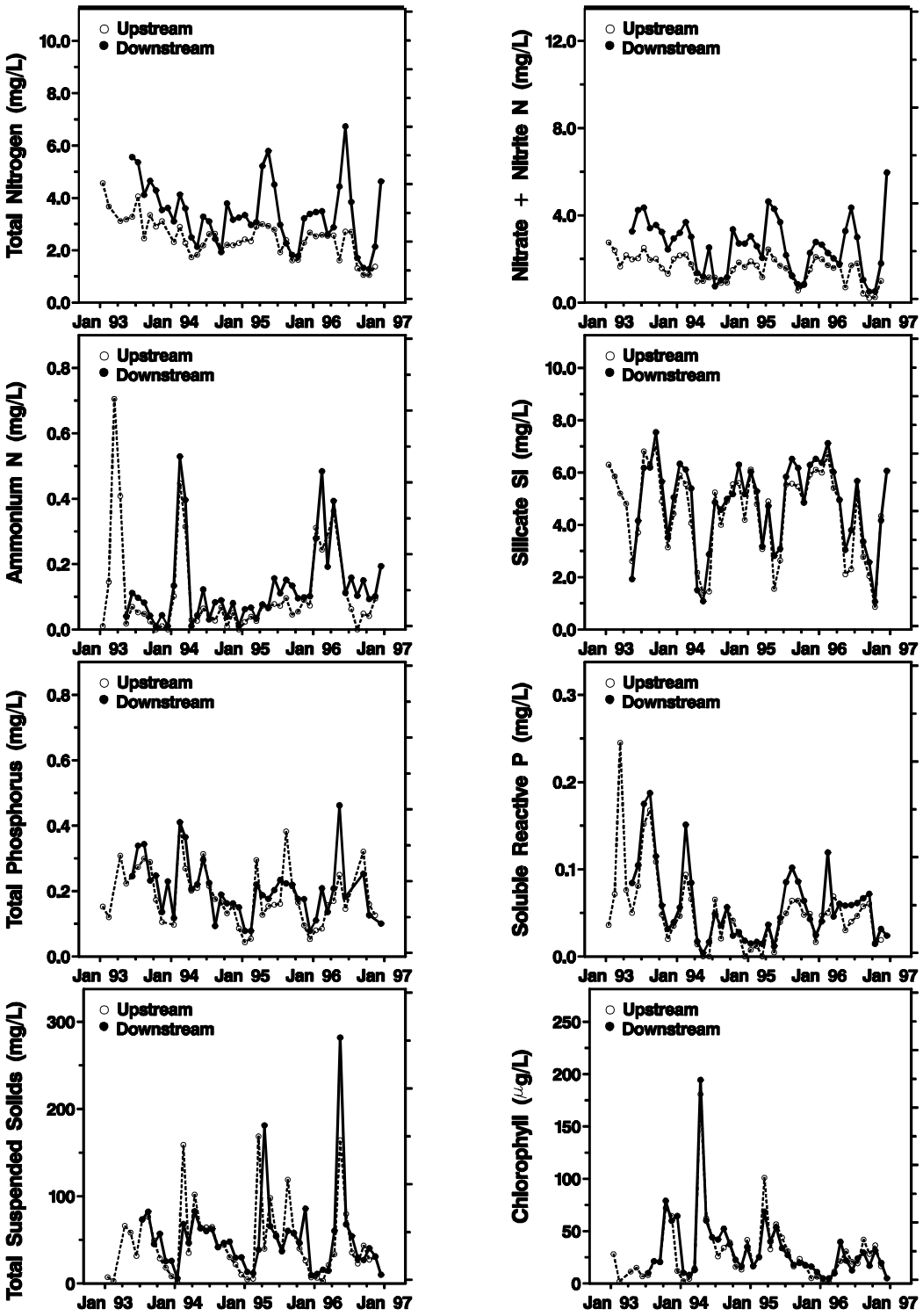

Figure E-2c. Monthly means of total nitrogen (mg/L), nitrate–nitrite nitrogen (mg/L), ammonium nitrogen (mg/L), silicate silicon (mg/L), total phosphorus (mg/L), soluble reactive phosphorus (mg/L), total suspended solids (mg/L), and chlorophyll *a* (µg/L) in upper and lower Pool 14 from 1993 through 1996.

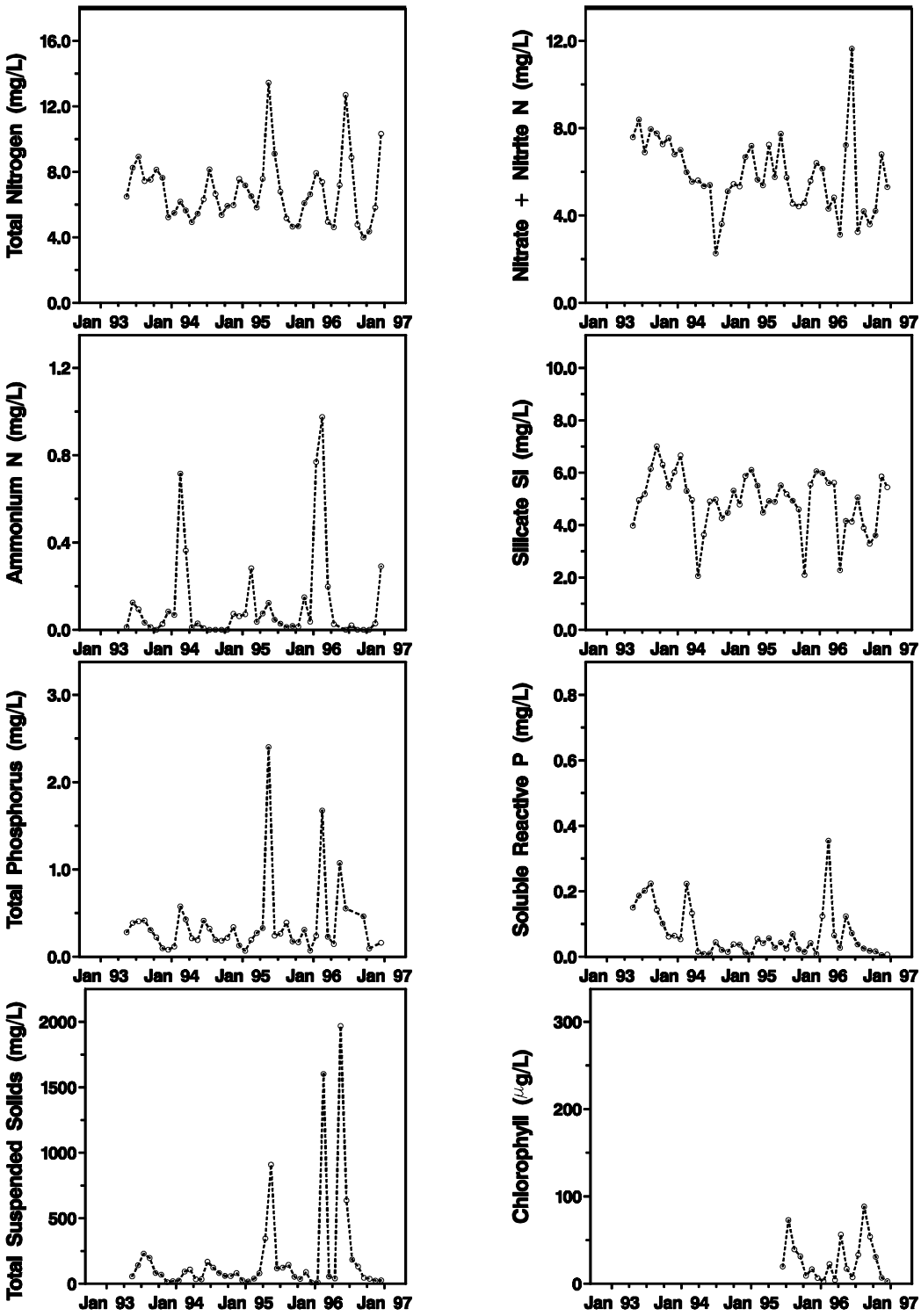

Figure E-2d. Monthly means of total nitrogen (mg/L), nitrate–nitrite nitrogen (mg/L), ammonium nitrogen (mg/L), silicate silicon (mg/L), total phosphorus (mg/L), soluble reactive phosphorus (mg/L), total suspended solids (mg/L), and chlorophyll *a* (µg/L) in the Maquoketa River from 1993 through 1996.

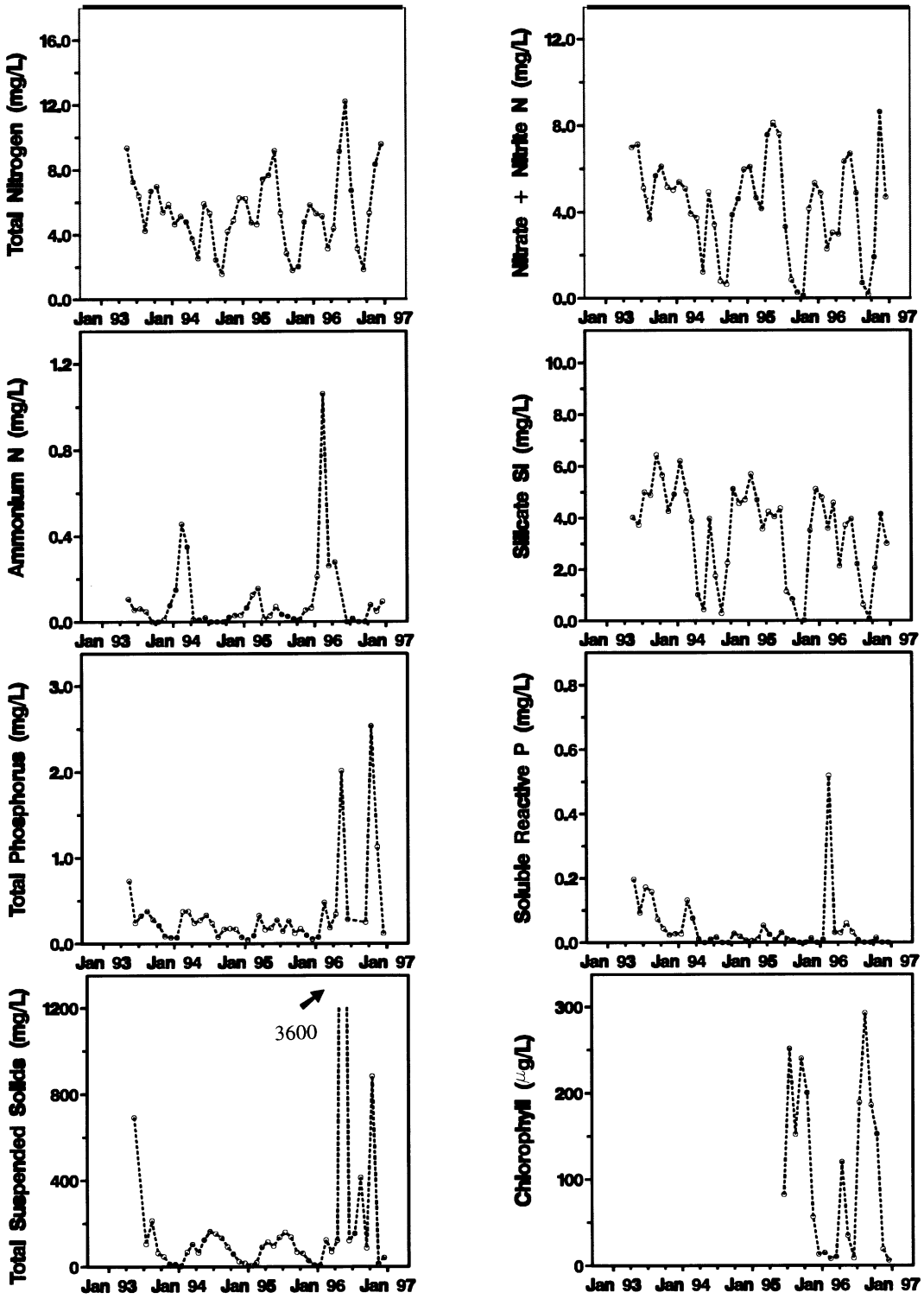

Figure E-2e. Monthly means of total nitrogen (mg/L), nitrate–nitrite nitrogen (mg/L), ammonium nitrogen (mg/L), silicate silicon (mg/L), total phosphorus (mg/L), soluble reactive phosphorus (mg/L), total suspended solids (mg/L), and chlorophyll *a* (µg/L) in the Wapsipinicon River from 1993 through 1996.

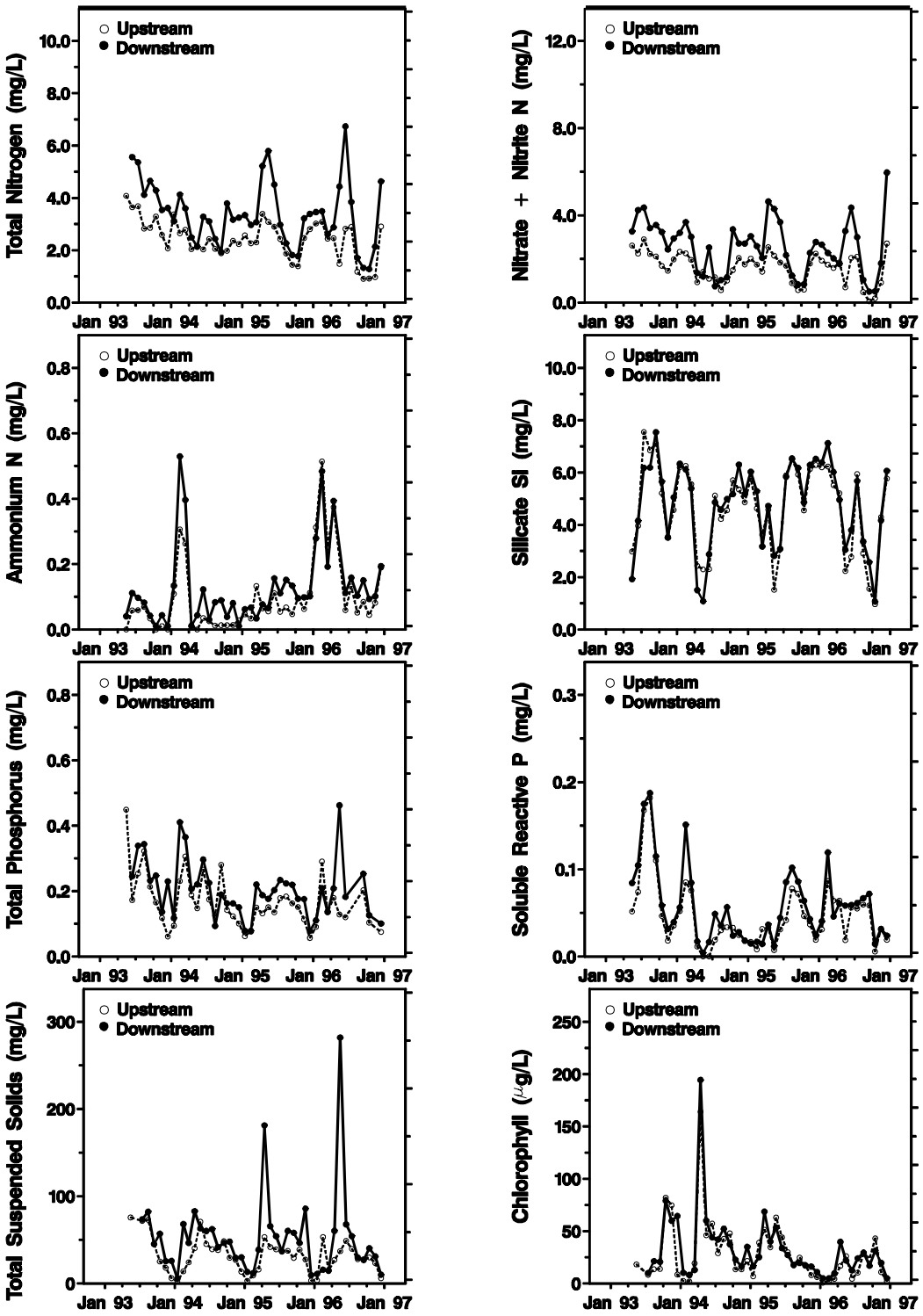

Figure E-2f. Monthly means of total nitrogen (mg/L), nitrate–nitrite nitrogen (mg/L), ammonium nitrogen (mg/L), silicate silicon (mg/L), total phosphorus (mg/L), soluble reactive phosphorus (mg/L), total suspended solids (mg/L), and chlorophyll *a* (µg/L) in upper Pool 12 (upstream) and lower Pool 14 (downstream) from 1993 through 1996.

Appendix F. Stratified Random Sampling Data: 1993–1996

In Appendix F, we summarize data from stratified random sampling (SRS) in both tabular and graphic forms. The tables contain summary statistics for each SRS episode and stratum divided into two parameter groups: (1) physical and biological measurements (Table F-1), and (2) chemical data (major plant nutrients; Table F-2). Within each parameter group, the data are divided by sampling depth into three groups (surface, middepth, and bottom). Chemical measurements are typically collected only at the surface and near the bottom. The majority of all measurement are in the near-surface category and most episodes do not have chemical data from other depths. Refer to Appendix A for maps and descriptions of the individual sampling strata and episodes.

The figures (F-1–F-13) are box-whisker diagrams that connect the medians for each sampling episode from spring 1993 through fall 1996. The 10th and 90th percentiles for each episode are indicated by the lower and upper limits of the box. Vertical lines extend above and below each box to the minimum and maximum observed value or to the limits of the plotting axis.

Data that have been flagged as questionable in the Long Term Resource Monitoring Program database because of recorder error, instrument malfunction, sample damage, contamination, improper handling, analytical error, or other difficulties are excluded from this summary. Values that are below detection are indicated by the detection limit preceded by a negative sign. Below-detection values are included in the determination of minima, maxima, and medians, but in the calculation of means and standard deviations, values below detection have been replaced by a value equal to half the detection limit. The Secchi transparency data in this report do not include observations where Secchi transparency exceeded the water column depth. High transparency conditions are thus underrepresented.

Table F-1. Summaries of physical–biological measurements during each stratified random sampling episode from 1993 through 1996. Data are grouped into three sampling-depth categories: near surface (less than or equal to 0.2 m below the surface), middepth, and near bottom (less than or equal to 0.2 m above the substrate).

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1993 Near-surface measurements: summer																			
1. Main channel	Mean	0.2	4.79	—	—	—	—	—	23.6	7.02	83	438	8	33	38	70.9	11.4	17.6	12
	Median	0.2	4.9	—	—	—	—	—	23.7	7	84	437	8	34	37	71.2	11.1	17.6	12.9
	Minimum	0.2	0.6	—	—	—	—	—	23	6.6	77	420	7.4	24	32	51	0.4	15	6.56
	Maximum	0.2	9.9	—	—	—	—	—	24.5	7.3	87	460	8.1	38	54	93.8	40.2	20.2	18.2
	Std. dev.	0	2.26	—	—	—	—	—	0.52	0.2	2.27	8.6	0.12	3.27	4.5	9.8	6.53	3.71	2.81
	N obs.	30	30	0	0	0	0	0	30	30	30	30	30	30	30	30	30	2	25
2. Side channel	Mean	0.2	3.56	0.48	—	—	—	—	23.7	7.01	83	436	8	33.6	36	64.6	9.6	17.2	11.8
	Median	0.2	3.4	0.48	—	—	—	—	23.9	7	83	438	8	34	35	65.9	10.3	16.5	10.9
	Minimum	0.2	0.9	0.48	—	—	—	—	22.3	6.6	79	424	7.9	30	31	46.1	-0.1	14.2	9.82
	Maximum	0.2	6.4	0.48	—	—	—	—	24.5	7.4	89	458	8.1	40	42	84.1	12.5	21	18.7
	Std. dev.	0	1.36	—	—	—	—	—	0.44	0.23	2.69	9.33	0.06	2.99	3	9.48	3.21	3.43	2.19
	N obs.	30	30	1	0	0	0	0	30	30	30	30	30	30	30	30	30	3	22
3. Backwater	Mean	0.2	2.44	0.14	—	—	—	—	23	7.07	83	430	8	36.3	29	42.7	7.7	24.1	16.4
	Median	0.2	1.5	0.07	—	—	—	—	23	7	83	435	8	36	28	35.9	9	24	14.6
	Minimum	0.2	0.4	0	—	—	—	—	21	1.7	19	300	7.2	24	3	0.8	-0.1	22.5	8.9
	Maximum	0.2	55	0.69	—	—	—	—	24	16.6	198	456	8.7	56	49	152	17.9	25.5	35.1
	Std. dev.	0	6.94	0.18	—	—	—	—	0.83	1.81	21.9	26.3	0.21	6.21	9.84	24.9	4.38	1.11	6.17
	N obs.	60	60	58	0	0	0	0	60	60	60	60	60	57	60	60	60	5	41
5. Impounded	Mean	0.2	1.24	0.3	—	—	—	—	23.8	7.66	91	437	8.1	31.9	40	78.6	11.1	16.5	8.53
	Median	0.2	1.2	0.33	—	—	—	—	23.9	7.25	86	436	8.1	32	39	78.3	11.6	15	8.93
	Minimum	0.2	0.4	0	—	—	—	—	20.8	6.6	78	415	7.5	16	9	4.4	0.4	9.36	0
	Maximum	0.2	3.1	0.54	—	—	—	—	25.5	15.3	176	484	8.8	44	84	188	27.6	26.2	14.1
	Std. dev.	0	0.67	0.16	—	—	—	—	1.21	1.74	19.4	16.3	0.2	6.43	15.7	41.2	6.12	6.53	4.41
	N obs.	30	30	30	0	0	0	0	30	30	30	30	30	29	30	30	30	5	22
1993 Near-surface measurements: fall																			
1. Main channel	Mean	0.2	4.77	—	—	—	—	—	12.2	13.3	124	412	8.8	43.6	22	33.3	10.4	103	64.6
	Median	0.2	4.9	—	—	—	—	—	12	13.1	122	411	8.8	44	21	32.9	10.5	103	60.5
	Minimum	0.2	0.5	—	—	—	—	—	11.7	11.4	106	404	8.6	30	16	17	8.5	103	42.3
	Maximum	0.2	9.2	—	—	—	—	—	13.9	14.7	136	419	9	55	43	56.5	12.3	103	89.9
	Std. dev.	0	2.16	—	—	—	—	—	0.47	0.83	7.44	4.02	0.09	6.26	5.26	6.79	1.05	—	14
	N obs.	30	30	0	0	0	0	0	30	30	30	30	30	30	30	30	30	1	30

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1993 Near-surface measurements: fall																			
2. Side channel	Mean	0.2	2.27	—	—	—	—	—	12.7	13.6	128	417	8.8	40.1	23	38	11	71.6	56.2
	Median	0.2	2.1	—	—	—	—	—	12.3	13.6	128	411	8.8	40	23	38.1	11.3	63.5	53.1
	Minimum	0.2	0.4	—	—	—	—	—	11.5	11.8	109	392	8.1	32	2	26.6	8.8	44.9	0
	Maximum	0.2	5.8	—	—	—	—	—	14.8	17	160	519	9.3	52	32	59.8	13.2	115	85.4
	Std. dev.	0	1.53	—	—	—	—	—	0.85	1.02	9.37	23.3	0.19	5.64	5.74	6.87	1.17	30	17.4
	N obs.	30	30	0	0	0	0	0	30	30	30	30	30	28	30	30	30	4	30
3. Backwater	Mean	0.2	0.97	0.06	—	—	—	—	12.7	14.8	139	426	8.9	33.8	29	42.3	13.7	52.9	57.6
	Median	0.2	0.8	0.01	—	—	—	—	12.8	14.2	134	412	8.9	34	26	38.8	13.4	44.4	53.1
	Minimum	0.2	0.4	0	—	—	—	—	10	10.4	99	333	7.8	20	14	15.2	3.3	13.5	0
	Maximum	0.2	2.4	0.41	—	—	—	—	15.1	20	195	730	9.5	48	54	164	29.9	109	130
	Std. dev.	0	0.56	0.1	—	—	—	—	0.98	2.6	26	53.5	0.28	7.65	9.88	20.2	4.02	29.5	25.2
	N obs.	63	59	55	0	0	0	0	59	59	59	59	59	55	59	59	59	8	59
5. Impounded	Mean	0.2	1.33	—	—	—	—	—	12.5	13.3	125	409	8.9	38.4	25	36.7	11.3	53.8	52.1
	Median	0.2	1.3	—	—	—	—	—	12.5	13.4	126	409	8.9	40	22	33.1	11.2	40.2	50.8
	Minimum	0.2	0.5	—	—	—	—	—	11.1	11.2	103	398	8.6	18	17	19.2	8.1	36.7	34.5
	Maximum	0.2	3.1	—	—	—	—	—	13.8	15.4	147	423	9	50	67	90.5	18.9	84.6	66.2
	Std. dev.	0	0.55	—	—	—	—	—	0.7	1.19	12	6.62	0.12	6.14	9.06	12.5	2.33	26.7	8.3
	N obs.	32	31	0	0	0	0	0	31	31	31	31	31	31	31	31	31	3	31
1994 Near-surface measurements: winter																			
1. Main channel	Mean	0.19	3.82	0.17	100	30	100	11	0.12	11.8	81	456	7.8	126	4	2.5	1.8	1.5	0
	Median	0.2	3.4	0.17	100	28	100	11	0.1	11.8	81	454	7.8	124	4	2.1	1.8	1.5	0
	Minimum	0	0.7	0.15	100	16	100	4	0	10.9	75	433	7.5	90	3	1.6	0.8	1.5	0
	Maximum	0.2	9.8	0.18	100	46	100	16	0.3	12.5	86	500	8.5	170	6	5.5	2.2	1.5	0
	Std. dev.	0.05	2.52	0.02	0	7.82	0	3.8	0.09	0.44	3.14	15.2	0.24	23.9	0.88	1	0.39	0	0
	N obs.	15	15	2	15	15	15	14	15	15	15	15	15	12	15	15	15	2	15
2. Side channel	Mean	0.2	2.44	0.14	100	29	100	8	0.11	11.7	80	461	7.8	146	4	2.5	1.8	1.5	0.04
	Median	0.2	2.5	0.15	100	30	100	8	0.1	11.7	80	460	7.8	139	4	2.4	1.7	1.5	0
	Minimum	0.2	0.3	0.03	100	14	100	3	0	11.1	76	442	7.5	116	3	1.5	0.6	1.12	0
	Maximum	0.2	6	0.22	100	40	100	19	0.3	12.5	86	499	8	192	6	4	4.5	1.87	1.17
	Std. dev.	0	1.33	0.06	0	7.17	0	5	0.08	0.38	2.61	13.8	0.14	26.4	1.01	0.65	0.66	0.53	0.22
	N obs.	30	30	14	30	30	30	30	29	29	29	29	29	22	29	29	29	2	29

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1994 Near-surface measurements: winter																			
3. Backwater	Mean	0.2	0.9	0.02	100	31	100	9	0.24	8.49	58	509	7.9	106	7	4.7	3	6.6	4.64
	Median	0.2	0.7	0	100	30	100	8	0	9.2	65	506	7.9	110	5	2.8	2.2	5.24	0
	Minimum	0	0.3	0	100	16	100	2	0	0.1	1	330	7	42	3	1.1	0.9	-1	0
	Maximum	0.2	3.7	0.15	100	46	100	22	1	12	83	713	8.3	168	66	22.8	16.9	17.6	40
	Std. dev.	0.03	0.66	0.04	0	5.79	0	5.2	0.34	3.51	24.1	72.1	0.25	43	10.1	4.74	2.55	6.31	8.81
	N obs.	58	56	51	58	58	58	58	51	51	51	51	51	12	51	51	51	10	49
5. Impounded	Mean	0.2	1.22	0.06	100	27	100	9	0.15	11.1	76	470	7.9	121	5	2.2	1.9	1.87	0.13
	Median	0.2	1	0.06	100	26	100	9	0.2	11	76	463	7.8	126	4	2.1	1.9	1.87	0
	Minimum	0.2	0.4	0	100	10	100	5	0	9	62	447	7.3	60	4	1.6	1.1	1.5	0
	Maximum	0.2	4.3	0.17	100	38	100	13	0.3	12.4	85	531	8.6	165	6	3.4	2.5	2.25	2.01
	Std. dev.	0	0.95	0.05	0	6.98	0	1.9	0.1	1.08	7.47	26	0.36	34.1	0.74	0.56	0.37	0.27	0.52
	N obs.	16	15	13	16	16	16	16	15	15	15	15	15	6	15	15	15	5	15
1994 Near-surface measurements: spring																			
1. Main channel	Mean	0.2	5.43	—	—	—	—	—	16.2	12.9	131	301	9.2	25.9	49	120	23.2	203	134
	Median	0.2	5.49	—	—	—	—	—	16.1	13.7	140	299	9.2	28	47	95.2	21.9	211	165
	Minimum	0.2	0.78	—	—	—	—	—	14.7	10.1	100	289	9	16	24	56.4	17.1	166	42.2
	Maximum	0.2	12.1	—	—	—	—	—	17.6	16.4	166	318	9.6	40	70	195	28.9	232	181
	Std. dev.	0	2.49	—	—	—	—	—	0.68	2.11	21.9	8.15	0.17	7.48	11.7	45.9	3.64	34	47.8
	N obs.	27	27	0	0	0	0	0	27	27	27	27	15	27	27	26	26	3	27
2. Side channel	Mean	0.2	2.82	0.52	—	—	—	—	16.3	12.9	132	304	9.2	25.8	50	103	21.9	211	124
	Median	0.2	2.74	0.52	—	—	—	—	16.6	13.5	139	300	9.3	28	49	90.4	21.3	211	131
	Minimum	0.2	0.3	0.1	—	—	—	—	14.1	10.1	98	287	9	14	31	57.2	18.3	201	47.2
	Maximum	0.2	5.79	1.12	—	—	—	—	17.8	16.1	164	329	9.7	33	75	188	29.2	221	174
	Std. dev.	0	1.31	0.21	—	—	—	—	1.08	1.93	22.1	13.6	0.16	4.89	11.6	32.7	2.43	13.9	39.4
	N obs.	31	31	31	0	0	0	0	31	31	31	29	23	31	31	31	31	2	31
3. Backwater	Mean	0.2	1.2	0.17	—	—	—	—	16.6	14.2	146	311	9.3	30.5	36	70.5	20.7	139	127
	Median	0.2	1.13	0.07	—	—	—	—	16.4	15.1	153	308	9.3	30	35	60	19.9	142	153
	Minimum	0.2	0.42	0	—	—	—	—	13.5	7.5	73	287	8.7	20	14	16.6	10.9	45.8	32.5
	Maximum	0.2	2.5	0.69	—	—	—	—	21	17.9	190	390	9.8	48	76	183	62.1	198	178
	Std. dev.	0	0.51	0.2	—	—	—	—	1.52	2.57	27.2	18.3	0.24	5.64	14.5	36.7	6.79	53.7	46.2
	N obs.	54	54	54	0	0	0	0	54	54	54	52	43	54	54	54	54	6	54

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1994 Near-surface measurements: spring																			
5. Impounded	Mean	0.2	1.87	0.39	—	—	—	—	12.7	11.6	110	329	9	25.7	54	110	19.9	143	71.6
	Median	0.2	1.55	0.38	—	—	—	—	12.8	11	102	332	9	27.5	45	86.3	19.1	149	49.8
	Minimum	0.2	0.5	0.14	—	—	—	—	10.4	10.2	94	285	8.5	14	23	47.7	13.2	54.3	10
	Maximum	0.2	6.4	0.82	—	—	—	—	17.1	18.1	188	350	9.6	37	96	232	31.5	222	173
	Std. dev.	0	1.25	0.17	—	—	—	—	1.43	2.06	23.6	13.9	0.32	6.1	22	52.2	5.59	68.7	51.9
	N obs.	38	38	35	0	0	0	0	38	38	38	38	38	38	38	38	38	4	38
1994 Near-surface measurements: summer																			
1. Main channel	Mean	0.2	4.45	—	—	—	—	—	25.3	7.7	95	410	8.2	36.7	36	49	11	24.6	28
	Median	0.2	4.88	—	—	—	—	—	25.2	7.55	93	410	8.2	38	34	41.9	10.4	24.3	24.9
	Minimum	0.2	0.4	—	—	—	—	—	24.9	6.9	84	397	7.9	18	18	23.3	7.7	19.7	0
	Maximum	0.2	7.92	—	—	—	—	—	25.9	9	112	433	8.6	46	95	257	25	29.9	53
	Std. dev.	0	1.93	—	—	—	—	—	0.28	0.57	7.29	8.84	0.17	5.44	13.6	40.7	2.91	4.79	11.2
	N obs.	30	30	0	0	0	0	0	30	30	30	30	30	30	30	30	30	4	30
2. Side channel	Mean	0.2	2.51	0.36	—	—	—	—	25.4	7.68	94	412	8.2	34.4	38	50.3	11.7	31.2	31.3
	Median	0.2	2.29	0.38	—	—	—	—	25.6	7.6	93	410	8.2	34	37	50.2	11.5	29.9	29.2
	Minimum	0.2	0.25	0.02	—	—	—	—	21.9	6.9	83	400	7.9	28	23	26.6	8.5	27.1	13.5
	Maximum	0.2	5.18	0.72	—	—	—	—	26.5	8.7	108	442	8.4	44	52	78.9	19.9	36.5	60.2
	Std. dev.	0	1.21	0.19	—	—	—	—	0.87	0.46	6.24	8.82	0.15	4.61	8.55	13.6	2.29	4.8	10.5
	N obs.	30	30	30	0	0	0	0	30	30	30	30	30	29	30	30	30	3	29
3. Backwater	Mean	0.2	1.03	0.08	—	—	—	—	25.1	8.42	103	418	8.3	28.7	46	52.4	14.6	62.2	46.9
	Median	0.2	0.74	0.03	—	—	—	—	25	8.2	101	416	8.2	28	46	47.5	13.5	41.2	31.9
	Minimum	0.2	0.21	0	—	—	—	—	21.9	4.9	61	360	7.7	18	18	13.5	8.5	24.3	14.5
	Maximum	0.2	7.32	0.38	—	—	—	—	27	13.1	159	543	9.7	48	84	126	25.8	142	152
	Std. dev.	0	1.01	0.1	—	—	—	—	1.16	1.79	22.1	32.4	0.37	5.93	11.9	18.6	4.32	54.3	36.3
	N obs.	62	59	59	0	0	0	0	59	59	59	59	59	57	59	59	59	4	59
5. Impounded	Mean	0.2	1.41	0.15	—	—	—	—	25.7	8.25	102	402	8.2	48.3	23	25.9	9.4	28.5	25.5
	Median	0.2	1.24	0.16	—	—	—	—	25.5	7.7	93	404	8.2	40	23	26.7	9.2	28.5	30.3
	Minimum	0.2	0.3	0	—	—	—	—	24.1	6.6	82	333	8	28	5	4.8	5.1	13.1	5
	Maximum	0.2	3.07	0.4	—	—	—	—	28	16	207	410	9	100	39	46.3	13.5	44	55.6
	Std. dev.	0	0.76	0.08	—	—	—	—	0.93	1.91	25.8	13.5	0.21	19.6	9.49	13.1	2.21	13.1	14.5
	N obs.	31	31	30	0	0	0	0	31	31	31	31	31	27	31	31	31	4	31

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1994 Near-surface measurements: fall																			
1. Main channel	Mean	0.2	4.1	0.2	—	—	—	—	14.7	8.78	86	371	7.9	40.3	31	41	6.4	16.7	13
	Median	0.2	3.94	0.2	—	—	—	—	14.5	8.65	85	369	7.9	40	31	41.1	6.2	16.5	12.9
	Minimum	0.2	0.54	0.2	—	—	—	—	13.7	7.8	77	362	7.8	32	18	15.1	4.9	12.7	4.48
	Maximum	0.2	9.14	0.2	—	—	—	—	15.6	9.6	94	391	8	58	42	55.9	9.2	21	20.1
	Std. dev.	0	2.23	—	—	—	—	—	0.69	0.67	5.64	6.02	0.09	5.45	5.69	8.74	1.08	4.13	3.27
	N obs.	30	30	1	0	0	0	0	30	30	30	30	30	30	30	30	30	3	30
2. Side channel	Mean	0.2	2.84	0.42	—	—	—	—	14.6	9.04	89	376	7.9	35.5	33	42.4	7.2	15.5	12.5
	Median	0.2	3.07	0.39	—	—	—	—	14.4	9.45	91	376	7.9	38	32	40.9	7.7	15	12.7
	Minimum	0.2	0.34	0.04	—	—	—	—	13.7	7.8	78	365	7.7	24	25	23.4	2.6	15	7.81
	Maximum	0.2	5.2	0.86	—	—	—	—	16.2	10.3	105	401	8.1	44	49	61.2	12	16.5	15.7
	Std. dev.	0	1.47	0.21	—	—	—	—	0.81	0.79	7.06	7.8	0.11	6.23	6.94	9.01	2.31	0.87	2.14
	N obs.	32	30	30	0	0	0	0	30	30	30	30	30	29	30	30	30	3	30
3. Backwater	Mean	0.2	1.1	0.08	—	—	—	—	14.3	9.14	90	393	8	33.6	33	38.5	7.5	21.1	18.7
	Median	0.2	0.88	0.02	—	—	—	—	14.8	8.8	84	391	7.9	32	34	33.4	7.1	18	13.1
	Minimum	0.2	0.2	0	—	—	—	—	11.5	4.8	44	333	7.4	20	14	14.6	3.9	9.73	7.26
	Maximum	0.2	7.4	0.5	—	—	—	—	16.6	14.2	146	465	9	54	64	95.9	16.2	41.9	88.1
	Std. dev.	0	0.98	0.13	—	—	—	—	1.32	1.69	17.6	26.1	0.33	8.11	10.5	17.6	2.19	12.2	15.1
	N obs.	64	60	60	0	0	0	0	60	60	60	60	60	54	60	60	60	5	60
5. Impounded	Mean	0.2	1.22	0.16	—	—	—	—	14.5	8.69	85	372	7.9	48.2	24	26.1	6.4	8.66	8
	Median	0.2	1.19	0.16	—	—	—	—	14.4	8.5	85	371	7.9	40	20	20.3	5.9	6.37	7.47
	Minimum	0.2	0.2	0.02	—	—	—	—	12.4	8	77	362	7.8	22	11	8	1.4	5.99	2.01
	Maximum	0.2	3.08	0.36	—	—	—	—	16	10.3	98	385	8.2	80	44	60.8	9.8	15.9	17.8
	Std. dev.	0	0.57	0.08	—	—	—	—	0.92	0.52	5.38	6.54	0.09	16.8	10.4	16.5	1.82	4.84	4.34
	N obs.	30	30	29	0	0	0	0	30	30	30	30	30	29	30	30	30	4	30
1995 Near-surface measurements: winter																			
1. Main channel	Mean	0.2	4.76	0.21	98.3	19	91	5	0	12.8	88	427	7.8	124	5	2.6	2.7	8.82	4.46
	Median	0.2	4.68	0.21	100	20	90	5	0	12.8	87	430	7.8	119	5	2.8	2.6	8.82	3.53
	Minimum	0.2	0.21	0.21	90	8	50	0	0	12.2	83	414	7.6	100	3	0.3	0.9	6.95	2.28
	Maximum	0.2	9.25	0.21	100	34	100	10	0.1	13.2	90	438	7.9	180	8	4.9	4.6	10.7	11.6
	Std. dev.	0	2.1	—	3.4	6.24	9.34	2.6	0.02	0.23	1.58	8.03	0.09	19.3	0.93	0.95	0.73	1.88	2.12
	N obs.	30	30	1	27	27	27	27	29	29	29	29	29	28	29	29	28	4	29

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1995 Near-surface measurements: winter																			
2. Side channel	Mean	0.2	1.88	0.13	95.3	16	90	4	0.03	12.7	87	444	7.8	122	5	4.4	2.9	8.19	5.79
	Median	0.2	1.36	0.15	100	16	90	3	0	12.7	87	442	7.8	120	5	3.1	2.5	6.55	3.9
	Minimum	0.2	0.2	0	60	4	40	0	0	12	82	417	7.7	60	4	1.6	1.3	3.74	2.49
	Maximum	0.2	6.9	0.28	100	32	100	13	0.2	15.1	104	507	8	190	12	32.7	8.4	13.9	31.7
	Std. dev.	0	1.58	0.08	10.4	5.93	11.6	3.6	0.06	0.54	3.77	23.8	0.07	32.5	1.39	5.85	1.41	4.42	5.53
	N obs.	30	30	27	30	30	30	30	30	30	30	30	30	17	30	30	26	5	30
3. Backwater	Mean	0.2	0.76	0.03	99.9	19	92	6	0.78	11.5	80	489	7.7	90.3	5	3.8	2.9	11	4.97
	Median	0.2	0.61	0	100	20	90	5	0.45	12.6	86	474	7.7	104	5	3.2	2.9	10.7	3.44
	Minimum	0.2	0.11	0	94	6	50	0	0	1.9	14	351	7.1	28	3	0.8	0.4	5.88	0
	Maximum	0.2	3.3	0.21	100	30	100	17	3	20	137	702	8.3	125	12	12.3	5.5	17.6	20.3
	Std. dev.	0	0.58	0.05	0.77	5.7	7.7	4.1	0.92	3.8	25.8	66	0.22	33.7	1.52	2.2	0.87	4.56	4.18
	N obs.	60	52	50	60	60	60	60	50	50	50	50	50	10	50	50	43	6	50
5. Impounded	Mean	0.2	1.19	0.08	100	18	90	6	0.01	12.8	88	451	7.7	116	5	3	2.5	5.89	2.64
	Median	0.2	1.08	0.07	100	18	90	4	0	12.8	87	449	7.7	113	5	2.6	2.5	5.89	2.41
	Minimum	0.2	0.2	0	100	10	90	0	0	8.5	58	432	7.2	106	4	0.4	0.6	5.35	1.25
	Maximum	0.2	4.75	0.16	100	26	90	20	0.2	16.4	113	542	8	130	6	17.4	5.9	6.42	5.68
	Std. dev.	0	0.89	0.04	0	3.9	0	5.3	0.05	1.15	7.93	23	0.13	8.29	0.53	2.96	0.89	0.76	0.85
	N obs.	30	29	27	30	30	30	30	27	27	27	27	27	10	27	27	27	2	27
1995 Near-surface measurements: spring																			
1. Main channel	Mean	0.2	5.87	—	—	—	—	—	10.2	13.7	122	406	8.6	40.3	27	52	10.6	50.5	69
	Median	0.2	5.23	—	—	—	—	—	9.9	13.7	120	405	8.6	40	27	48.8	10.4	50.5	71.6
	Minimum	0.2	0.98	—	—	—	—	—	9.4	12.2	108	376	8.4	30	18	33.2	9.3	49.4	46.6
	Maximum	0.2	17.7	—	—	—	—	—	11.6	14.7	135	446	8.8	48	45	89.7	12.5	51.6	90.3
	Std. dev.	0	3.16	—	—	—	—	—	0.71	0.59	6.84	14.7	0.11	4.25	6.22	13.7	0.76	1.58	10.9
	N obs.	30	30	0	0	0	0	0	30	30	30	30	30	30	30	30	30	2	30
2. Side channel	Mean	0.2	3.23	0.54	—	—	—	—	10.3	13.9	124	407	8.7	40.7	26	47.8	10.3	70.4	66.5
	Median	0.2	3.35	0.57	—	—	—	—	9.95	13.7	122	403	8.7	40.5	25	47.8	10.3	68.1	66
	Minimum	0.2	0.46	0.1	—	—	—	—	9.6	12.8	113	377	8.5	30	21	26	8.5	58.4	50.8
	Maximum	0.2	10	1	—	—	—	—	11.9	17.5	162	437	9	48	34	74.6	12.1	84.6	92.8
	Std. dev.	0	1.97	0.22	—	—	—	—	0.66	0.91	9.69	15.2	0.12	4.05	3.21	9.32	0.96	13.2	10.3
	N obs.	30	30	30	0	0	0	0	30	29	29	30	30	30	30	30	30	3	30

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1995 Near-surface measurements: spring																			
3. Backwater	Mean	0.2	1.65	0.17	—	—	—	—	10.6	14.6	132	396	8.8	42.5	25	42.1	10.5	68.6	63.5
	Median	0.2	1.34	0.07	—	—	—	—	10.3	13.8	124	400	8.7	42	22	30.4	10	69.2	61.6
	Minimum	0.2	0.25	0	—	—	—	—	9.3	12.4	110	306	8.4	20	12	15.1	6.9	57.6	29.3
	Maximum	0.2	4.27	0.9	—	—	—	—	12.4	20.5	192	434	9.2	60	69	128	22.4	76.3	105
	Std. dev.	0	0.93	0.2	—	—	—	—	0.92	1.92	19.9	27.5	0.2	9.56	10.4	26.1	2.71	6.55	16.4
	N obs.	61	59	59	0	0	0	0	59	59	59	59	59	58	59	59	59	6	59
5. Impounded	Mean	0.2	1.17	0.27	—	—	—	—	11	14.9	135	415	8.7	40.7	26	55.4	11.1	69.6	60.4
	Median	0.2	1.22	0.28	—	—	—	—	10.7	14.7	134	407	8.7	40	25	52.4	11.3	81.6	60.7
	Minimum	0.2	0.58	0.06	—	—	—	—	9.6	13.2	116	386	8.5	33	16	22.2	8.8	43.4	31.9
	Maximum	0.2	2.44	0.45	—	—	—	—	14.5	17.2	160	541	8.9	50	37	163	12.9	83.8	80.1
	Std. dev.	0	0.43	0.09	—	—	—	—	1.12	1.03	11.7	29	0.11	3.93	5.33	25	1.05	22.7	11.2
	N obs.	31	30	30	0	0	0	0	30	30	30	30	30	30	30	30	30	3	30
1995 Middepth measurements: spring																			
3. Backwater	Mean	0.4	1.52	0.2	—	—	—	—	10.1	14.4	128	405	8.9	—	31	58	12.2	60.6	54.6
	Median	0.4	1.52	0.2	—	—	—	—	10.1	14.4	128	405	8.9	—	31	58	12.2	60.6	54.6
	Minimum	0.4	1.52	0.2	—	—	—	—	10.1	14.4	128	405	8.9	—	31	58	12.2	60.6	54.6
	Maximum	0.4	1.52	0.2	—	—	—	—	10.1	14.4	128	405	8.9	—	31	58	12.2	60.6	54.6
	Std. dev.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	N obs.	1	1	1	—	—	—	—	1	1	1	1	1	—	1	1	1	1	1
1995 Near-surface measurements: summer																			
1. Main channel	Mean	0.2	4.55	—	—	—	—	—	27.9	6.96	90	497	8.3	40.7	30	49.1	8.7	27.6	30.3
	Median	0.2	4.55	—	—	—	—	—	27.8	6.9	90	486	8.3	40	29	41.8	8.7	28.1	30.5
	Minimum	0.2	0.75	—	—	—	—	—	26.7	6	76	477	8.1	32	24	29.9	6.6	26.7	23.4
	Maximum	0.2	8.97	—	—	—	—	—	29.6	8.6	115	521	8.4	48	38	211	11.1	28.1	41.4
	Std. dev.	0	2.13	—	—	—	—	—	0.69	0.66	9.55	16.2	0.08	4.66	3.77	33	1.18	0.77	3.89
	N obs.	30	30	0	0	0	0	0	30	30	30	30	30	30	25	30	30	3	30
2. Side channel	Mean	0.2	2.6	0.31	—	—	—	—	27.7	6.88	89	500	8.2	37.1	33	51.8	9.4	18	32.6
	Median	0.2	2.3	0.35	—	—	—	—	27.7	7	90	493	8.2	37	33	46.8	9.5	18	32.5
	Minimum	0.2	0.3	0	—	—	—	—	26.6	5.6	71	479	8.1	25	22	24	7.5	17.8	20.8
	Maximum	0.2	7.88	0.69	—	—	—	—	29.1	9.1	120	525	8.4	46	40	217	11.8	18.2	47.4
	Std. dev.	0	1.69	0.16	—	—	—	—	0.67	0.87	12.1	15.8	0.1	4.87	4.68	32.8	1.13	0.28	6.37
	N obs.	30	30	30	0	0	0	0	30	30	30	30	30	29	30	30	30	2	30

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1995 Near-surface measurements: summer																			
3. Backwater	Mean	0.2	1.05	0.07	—	—	—	—	28.2	7.56	99	486	8.3	31	39	55.4	13.3	54.2	56.9
	Median	0.2	0.85	0.04	—	—	—	—	28	7.1	91	504	8.3	32	35	46.3	11.9	30.7	43.6
	Minimum	0	0.28	0	—	—	—	—	26	1.4	18	247	7.1	18	4	2.7	3.7	12.2	3.77
	Maximum	0.2	7	0.42	—	—	—	—	30.8	12.2	160	539	9	49	150	268	58.4	137	192
	Std. dev.	0.03	0.97	0.1	—	—	—	—	1.12	2.41	32.6	53.8	0.33	8	19.5	47.5	7.29	40.8	38.4
	N obs.	63	60	60	0	0	0	0	60	60	60	60	60	54	59	60	60	9	60
5. Impounded	Mean	0.2	1.16	0.12	—	—	—	—	29.2	7.62	101	481	8.3	31.3	32	44.3	9.7	24.3	32.6
	Median	0.2	1.09	0.14	—	—	—	—	29.1	7.7	102	482	8.3	30	33	39.7	9.9	24.3	30.5
	Minimum	0.2	0.44	0	—	—	—	—	28.3	6.2	81	403	8.1	20	23	11.4	6.5	24.3	0
	Maximum	0.2	3.05	0.25	—	—	—	—	30.8	10.6	141	497	8.7	51	42	202	12.5	24.3	64.4
	Std. dev.	0	0.59	0.07	—	—	—	—	0.73	1.09	15.4	16.1	0.13	6.65	5.69	31.5	1.38	—	13.5
	N obs.	31	30	30	0	0	0	0	30	30	30	30	30	29	14	30	30	1	30
1995 Near-surface measurements: fall																			
1. Main channel	Mean	0.2	5.35	—	—	—	—	—	11.1	9.65	88	334	8	38.9	33	45.8	8.7	10.7	15.6
	Median	0.2	5.2	—	—	—	—	—	12	9.45	87	336	8	40	32	47.5	9.1	11.4	15.9
	Minimum	0.2	0.4	—	—	—	—	—	8.4	9.1	84	305	7.9	18	17	14.4	4.3	7.13	6.33
	Maximum	0.2	9.5	—	—	—	—	—	13.6	10.6	92	366	8.1	46	50	72.2	12.5	12.8	26.1
	Std. dev.	0	2.1	—	—	—	—	—	1.4	0.42	1.7	15.6	0.05	6.04	7.25	13	2.12	2.73	4.72
	N obs.	30	30	0	0	0	0	0	30	30	30	30	30	30	30	30	30	4	29
2. Side channel	Mean	0.2	3.12	0.45	—	—	—	—	11.2	9.71	88	332	8	39	33	44.8	8.3	14.9	15.6
	Median	0.2	3.25	0.46	—	—	—	—	11.4	9.6	88	331	8	40	31	40.7	8	12.8	13.4
	Minimum	0.2	0.4	0.02	—	—	—	—	9.2	8.9	83	308	7.9	20	23	27.8	6.3	11.4	7.24
	Maximum	0.2	7	0.8	—	—	—	—	12.9	10.7	93	360	8.1	48	45	67.6	12.4	24.2	28.9
	Std. dev.	0	1.64	0.18	—	—	—	—	1.18	0.5	2.79	16.7	0.07	5.14	6.14	10.7	1.42	5.34	5.84
	N obs.	30	30	29	0	0	0	0	30	30	30	30	30	30	30	30	30	5	30
3. Backwater	Mean	0.2	1.47	0.13	—	—	—	—	12.7	9.87	93	329	8.1	36.1	32	35.8	8.8	14.9	22.9
	Median	0.2	1.23	0.07	—	—	—	—	13.2	9.7	92	320	8	38	31	33.6	8.7	10.7	20.2
	Minimum	0.2	0.4	0	—	—	—	—	8.7	7.3	67	305	7.7	20	12	15.2	5.7	9.62	9.3
	Maximum	0.2	4.12	0.59	—	—	—	—	16.2	14.1	136	390	9	59	51	87.1	12.7	24.2	71.9
	Std. dev.	0	0.84	0.14	—	—	—	—	1.76	1.16	11.5	24.3	0.26	7.62	9.05	14.9	1.67	8.15	13.6
	N obs.	62	60	60	0	0	0	0	60	59	59	60	60	59	60	60	60	3	60

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1995 Near-surface measurements: fall																			
5. Impounded	Mean	0.2	1.33	0.16	—	—	—	—	9.2	10.7	93	352	8.1	41	30	34.3	6.8	12.5	10.6
	Median	0.2	1.29	0.18	—	—	—	—	9.1	10.6	92	349	8.1	39	28	29.1	7	13.9	10.3
	Minimum	0.2	0.4	0	—	—	—	—	8.4	10.2	89	332	8.1	18	15	14.5	4.3	9.62	0
	Maximum	0.2	2.5	0.38	—	—	—	—	10.8	12	107	393	8.4	60	90	155	14.7	13.9	20.5
	Std. dev.	0	0.58	0.1	—	—	—	—	0.6	0.4	4.46	10.1	0.08	9.45	13.9	26.2	2.16	2.47	4.09
	N obs.	30	30	30	0	0	0	0	30	30	30	30	30	30	30	30	30	3	30
1996 Near-surface measurements: winter																			
1. Main channel	Mean	0.2	4.93	—	100	30	100	8	0.1	10.8	74	412	7.4	102	5	2.3	2.4	-.19	0
	Median	0.2	4.5	—	100	31	100	7	0.1	10.8	74	412	7.4	94	5	2.3	2.4	-1	0
	Minimum	0.2	2.1	—	100	21	100	4	0.1	10.2	70	395	7.3	64	4	0.6	1.7	-1	0
	Maximum	0.2	8.6	—	100	40	100	11	0.1	11.4	78	437	7.6	150	6	3.2	2.8	1.43	0
	Std. dev.	0	1.62	—	0	4.77	0	1.9	0	0.41	2.83	10.9	0.08	27.6	0.63	0.69	0.29	1.4	0
	N obs.	16	16	0	16	16	16	16	16	16	16	16	16	16	16	16	16	3	16
2. Side channel	Mean	0.19	2.64	0.22	100	29	89	7	0.09	10.7	73	412	7.4	91.4	8	5.6	2.9	0.82	0.69
	Median	0.2	2.92	0.24	100	29	100	9	0.1	10.5	72	415	7.4	96	5	2.7	2.5	1.43	0
	Minimum	0	0.25	0	100	18	0	0	0	9.6	66	356	7.3	29	5	1.8	1.9	-1	0
	Maximum	0.2	5.5	0.4	100	50	100	11	0.1	11.9	81	453	7.7	150	31	32.5	6.6	1.43	18.6
	Std. dev.	0.04	1.52	0.11	0	7.54	30.7	3.7	0.03	0.56	3.84	22.7	0.1	30.8	7.47	7.91	1.22	1.21	3.45
	N obs.	30	30	29	30	30	30	30	29	29	29	29	29	25	27	29	29	4	29
3. Backwater	Mean	0.17	0.94	0.04	100	31	87	7	0.24	8.8	61	464	7.4	75.2	10	7.2	3.8	9.27	10
	Median	0.2	0.77	0	100	31	100	9	0.2	10	69	450	7.4	77	7	4	3.2	9.27	0.95
	Minimum	0	0.2	0	100	17	0	0	0	0.7	5	320	7.1	28	4	1.2	1.8	9.27	0
	Maximum	0.2	3.4	0.3	100	43	100	16	1	12.3	86	691	7.7	139	51	38.9	9.3	9.27	99.6
	Std. dev.	0.06	0.62	0.08	0	6.2	34.3	4.2	0.23	2.7	18.6	77	0.12	31.5	9.26	8.83	1.63	—	19.5
	N obs.	60	60	57	60	60	60	60	57	57	57	57	57	30	55	56	56	1	55
5. Impounded	Mean	0.18	1.17	0.09	100	34	93	5	0.09	10.8	74	438	7.5	98.1	6	3.6	2.7	-0.6	0.1
	Median	0.2	1.11	0.11	100	34	100	5	0.1	10.7	73	428	7.6	105	5	2.2	2.6	-1	0
	Minimum	0	0.38	0	100	25	0	0	0	9.6	66	380	7.3	29	4	1.4	1.8	-1	0
	Maximum	0.2	3.87	0.25	100	45	100	9	0.1	11.8	81	531	7.8	150	24	25.7	5.4	1.43	1.85
	Std. dev.	0.06	0.65	0.06	0	5.56	25.4	2.1	0.03	0.57	3.94	30.8	0.14	32.5	4.57	5.54	0.81	0.99	0.4
	N obs.	30	30	30	30	30	30	30	30	30	30	30	30	18	30	30	30	6	30

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1996 Near-surface measurements: spring																			
1. Main channel	Mean	0.2	5.64	—	—	—	—	—	10.3	10.8	96	285	7.9	46.6	26	48.8	7.2	31.7	32.1
	Median	0.2	5.8	—	—	—	—	—	10.5	10.7	97	295	7.9	48	26	49.7	7.3	31.7	29.6
	Minimum	0.2	1.28	—	—	—	—	—	9.2	10.2	89	215	7.7	34	14	21.7	5.5	25	20.7
	Maximum	0.2	10.8	—	—	—	—	—	11.6	11.6	104	308	8.2	60	34	73.1	8.6	38.5	50.7
	Std. dev.	0	2.66	—	—	—	—	—	0.68	0.41	4.93	25.8	0.13	5.99	4.55	11.4	0.85	9.57	8.73
	N obs.	30	30	0	0	0	0	0	30	30	30	30	30	30	30	30	24	2	30
2. Side channel	Mean	0.2	4.38	0.68	—	—	—	—	10.7	10.9	98	294	7.9	48.4	24	41.3	6.6	29	31.3
	Median	0.2	4.57	0.68	—	—	—	—	10.8	10.9	98	292	7.9	49	25	39.8	6.5	32.1	30.8
	Minimum	0.2	1.22	0.15	—	—	—	—	9.5	10.3	91	230	7.8	36	15	16.9	5.4	22.1	22.1
	Maximum	0.2	8.33	1.32	—	—	—	—	11.6	11.4	103	313	8.1	62	32	72.1	8	32.8	43.7
	Std. dev.	0	1.56	0.26	—	—	—	—	0.56	0.31	3.67	16.2	0.07	5.89	3.65	12.8	0.65	5.98	5.61
	N obs.	30	30	28	0	0	0	0	30	30	30	30	30	30	30	30	25	3	30
3. Backwater	Mean	0.2	2.1	0.16	—	—	—	—	10.8	11.2	101	268	8.1	51.8	20	27.3	6.7	48.2	43.1
	Median	0.2	2	0.1	—	—	—	—	10.8	10.8	97	284	8	50	21	26.8	6.2	32.8	34.8
	Minimum	0.2	0.8	0	—	—	—	—	8.4	9.8	88	217	7.8	32	10	10.3	4	21.4	22.3
	Maximum	0.2	4.88	0.76	—	—	—	—	13.5	15	140	320	9.3	72	30	69.5	17.2	168	169
	Std. dev.	0	0.68	0.18	—	—	—	—	1.17	1.14	12.3	39.9	0.33	9.54	6.27	13	2.34	48.8	25.4
	N obs.	60	60	53	0	0	0	0	60	60	60	60	60	60	60	60	50	8	60
5. Impounded	Mean	0.2	1.94	0.37	—	—	—	—	10.6	11.1	100	259	8.1	46.9	24	44	7.3	35.6	38.7
	Median	0.2	2	0.38	—	—	—	—	10.5	11.1	99	257	8.1	50	20	32.4	6.9	35.6	40.6
	Minimum	0.2	1	0.08	—	—	—	—	9.9	10.5	93	214	7.8	28	14	17.1	5.4	34.2	23.9
	Maximum	0.2	3.05	0.62	—	—	—	—	13	12.7	118	310	8.5	62	45	107	10.4	37.1	64.2
	Std. dev.	0	0.57	0.14	—	—	—	—	0.56	0.57	6.21	32.9	0.2	8.92	8.92	22	1.42	2.02	9.57
	N obs.	30	30	13	0	0	0	0	30	30	30	30	30	30	30	30	19	2	30
1996 Near-surface measurements: summer																			
1. Main channel	Mean	0.2	4.59	—	—	—	—	—	24.4	7.13	86	426	8	56	20	25.8	6.9	12.8	18.4
	Median	0.2	4.69	—	—	—	—	—	24.4	7	84	428	8.1	54	20	27.8	7	12.3	13.9
	Minimum	0.2	0.52	—	—	—	—	—	23.1	6.5	78	405	7.8	34	11	10.8	4.6	9.75	6
	Maximum	0.2	9.14	—	—	—	—	—	25	8.9	109	454	8.3	82	29	41.9	10.7	17.5	56.9
	Std. dev.	0	1.92	—	—	—	—	—	0.42	0.54	6.55	16.4	0.09	9.92	4.42	6.25	1.08	3.14	10.8
	N obs.	30	30	0	0	0	0	0	30	30	30	30	30	30	30	30	30	5	30

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1996 Near-surface measurements: summer																			
2. Side channel	Mean	0.2	3.25	0.35	—	—	—	—	24.2	7.22	87	428	8.1	48.4	21	28.1	6.9	12.8	19.5
	Median	0.2	3.13	0.31	—	—	—	—	24.2	7.15	86	420	8	49	22	27.9	7.1	12.8	15
	Minimum	0.2	1.01	0.18	—	—	—	—	23.3	6.2	74	405	7.8	38	13	16.2	5.2	8.89	6.09
	Maximum	0.2	8.84	0.75	—	—	—	—	25.2	8.9	109	463	8.2	70	31	40.6	8.2	16.6	128
	Std. dev.	0	1.64	0.13	—	—	—	—	0.43	0.66	8.37	19.3	0.13	7.58	4.16	5.96	0.76	5.46	21.3
	N obs.	30	30	30	0	0	0	0	30	30	30	30	30	30	30	30	30	2	30
3. Backwater	Mean	0.2	0.9	0.05	—	—	—	—	24.2	7.9	95	430	8.2	31	34	44.4	10.8	33.5	33.1
	Median	0.2	0.74	0.02	—	—	—	—	24.1	7.85	94	439	8.1	29	36	44	9.9	33.4	24.3
	Minimum	0.2	0.35	0	—	—	—	—	22.5	1.1	13	266	7.4	12	7	7	4.8	11.9	0.63
	Maximum	0.2	2.7	0.31	—	—	—	—	27.1	15.4	192	530	9.2	58	64	111	26.7	54.5	150
	Std. dev.	0	0.54	0.07	—	—	—	—	1.04	2.45	30.6	52.8	0.33	11.4	15.5	22.4	4.24	16.6	30.7
	N obs.	64	60	60	0	0	0	0	60	60	60	60	60	51	60	60	60	6	60
5. Impounded	Mean	0.2	1.26	0.13	—	—	—	—	24.4	8.2	99	428	8.2	55.1	19	23.3	6.6	17.9	18.5
	Median	0.2	1.21	0.15	—	—	—	—	24.4	8.3	100	430	8.2	51	19	21.1	6.4	17.9	16.3
	Minimum	0.2	0.36	0	—	—	—	—	22.9	6.7	79	405	7.9	21	8	6	4.2	17.2	3.64
	Maximum	0.2	2.8	0.23	—	—	—	—	26.7	10.6	124	455	8.9	120	44	79.5	12.2	18.6	42.8
	Std. dev.	0	0.58	0.06	—	—	—	—	0.75	0.8	10.1	16.5	0.18	23.1	8.33	14.3	1.72	1.01	10.1
	N obs.	30	30	30	0	0	0	0	30	30	30	30	30	27	30	30	30	2	30
1996 Near-surface measurements: fall																			
1. Main channel	Mean	0.2	4.62	—	—	—	—	—	14.6	9.38	92	366	8.5	55.7	17	21.6	5.7	13.1	11.5
	Median	0.2	4.6	—	—	—	—	—	14.8	9.1	89	365	8.4	58	16	20.5	5.7	13.6	10.3
	Minimum	0.2	0.4	—	—	—	—	—	13	8.5	84	357	8.2	40	13	14.6	4.7	10.2	4.38
	Maximum	0.2	8.6	—	—	—	—	—	16.4	12.3	126	389	8.9	64	23	35.4	7.1	15.4	20.3
	Std. dev.	0	2.19	—	—	—	—	—	0.77	0.94	9.99	6.58	0.19	6.86	2.53	4.17	0.65	2.63	3.86
	N obs.	30	30	0	0	0	0	0	30	30	30	30	30	29	30	30	30	3	30
2. Side channel	Mean	0.2	2.46	0.2	—	—	—	—	14.4	9.04	89	370	8.4	48.9	20	26.1	6	10.9	9.17
	Median	0.2	2.59	0.17	—	—	—	—	14.3	9.1	88	370	8.4	48	20	24.9	6	11.1	8.42
	Minimum	0.2	0.78	0.01	—	—	—	—	13	8.6	83	358	8.1	34	13	17.6	5.1	9.27	0
	Maximum	0.2	5.2	0.46	—	—	—	—	15.4	10.6	103	409	8.8	65	30	37.6	7.4	12.4	17.4
	Std. dev.	0	1.28	0.13	—	—	—	—	0.76	0.38	3.37	10.5	0.12	8.3	4.38	5.55	0.67	1.57	3.08
	N obs.	32	30	30	0	0	0	0	30	30	30	30	30	30	30	30	30	3	30

Table F-1. Continued.

Sampling stratum	Statistic	Sample depth (m)	Water depth (m)	Water velocity (m/s)	Ice cover (%)	Thickness of ice (cm)	Snow cover (%)	Snow depth (cm)	Water temp. (°C)	Dissolved oxygen (mg/L)	Oxygen saturation (%)	Specific cond. (µS)	pH	Secchi depth (cm)	Turbidity (NTU)	Total suspended solids (mg/L)	Volatile suspended solids (mg/L)	Spectr. chl. (µg/L)	Fluor. chl. (µg/L)
1996 Near-surface measurements: fall																			
3. Backwater	Mean	0.2	0.79	0.03	—	—	—	—	13.4	9.97	96	396	8.5	33.6	34	39.2	11.2	25.6	31.1
	Median	0.2	0.57	0	—	—	—	—	13.4	10	95	397	8.5	30	31	38.4	9.3	27.3	20.7
	Minimum	0.2	0.3	0	—	—	—	—	10.8	7.1	66	326	7.8	16	12	12.2	5.1	8.64	2.47
	Maximum	0.2	2.74	0.23	—	—	—	—	16.4	13.1	126	484	9.2	60	86	85.3	38.9	39.1	145
	Std. dev.	0	0.57	0.05	—	—	—	—	1.06	1.36	13.2	29.8	0.3	11.8	17.1	16.5	5.79	12.6	28.9
	N obs.	70	60	60	0	0	0	0	60	59	59	60	60	50	60	60	60	4	60
5. Impounded	Mean	0.2	1.2	0.06	—	—	—	—	13.6	9.86	95	369	8.5	51.3	18	20.6	6	9.43	8.25
	Median	0.2	1.14	0.06	—	—	—	—	14.2	9.6	95	369	8.5	50	17	20	6.2	7.63	8.17
	Minimum	0.2	0.4	0	—	—	—	—	9.7	9.1	82	362	8.1	32	10	12.7	4.5	3.82	1.11
	Maximum	0.2	4.5	0.14	—	—	—	—	17.2	12.2	125	378	8.9	90	30	31	8	16.8	21.9
	Std. dev.	0	0.72	0.04	—	—	—	—	1.86	0.8	10.4	4.13	0.24	11.9	4.36	4.87	0.9	5.09	5.28
	N obs.	32	30	30	0	0	0	0	30	29	29	30	30	27	30	30	30	5	30

Table F-2. Summaries of chemical measurements during each stratified random sampling episode from 1993 through 1996. Data are grouped into three sampling-depth categories: near surface (less than 0.2 m below the surface), middepth, and near bottom (less than 0.2 m above the substrate).

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1993 Near-surface measurements: summer													
1. Main channel	Mean	2.735	0.03	2.35	0.315	0.13	—	—	—	—	—	—	—
	Median	2.494	0.03	2.311	0.31	0.114	—	—	—	—	—	—	—
	Minimum	2.078	-0.02	2.019	0.27	0.051	—	—	—	—	—	—	—
	Maximum	3.621	0.054	3.299	0.365	0.184	—	—	—	—	—	—	—
	Std. dev.	0.522	0.011	0.331	0.03	0.038	—	—	—	—	—	—	—
	N obs.	16	16	16	16	16	0	0	0	0	0	0	0
2. Side channel	Mean	2.467	0.026	2.244	0.329	0.123	—	—	—	—	—	—	—
	Median	2.26	0.023	2.249	0.314	0.109	—	—	—	—	—	—	—
	Minimum	1.801	-0.02	1.994	0.289	0.1	—	—	—	—	—	—	—
	Maximum	3.396	0.048	2.789	0.415	0.186	—	—	—	—	—	—	—
	Std. dev.	0.45	0.013	0.234	0.032	0.029	—	—	—	—	—	—	—
	N obs.	16	16	16	16	16	0	0	0	0	0	0	0
3. Backwater	Mean	2.496	0.03	2.162	0.305	0.104	—	—	—	—	—	—	—
	Median	2.321	0.029	2.132	0.304	0.105	—	—	—	—	—	—	—
	Minimum	2	-0.02	0.91	0.213	0.031	—	—	—	—	—	—	—
	Maximum	3.465	0.057	3.146	0.384	0.162	—	—	—	—	—	—	—
	Std. dev.	0.394	0.012	0.425	0.046	0.033	—	—	—	—	—	—	—
	N obs.	32	32	32	32	32	0	0	0	0	0	0	0
5. Impounded	Mean	3.27	0.037	2.531	0.355	0.137	—	—	—	—	—	—	—
	Median	3.144	0.038	2.307	0.322	0.165	—	—	—	—	—	—	—
	Minimum	2.434	-0.02	1.92	0.258	-0.01	—	—	—	—	—	—	—
	Maximum	4.306	0.065	3.81	0.807	0.186	—	—	—	—	—	—	—
	Std. dev.	0.574	0.015	0.599	0.132	0.053	—	—	—	—	—	—	—
	N obs.	16	15	15	16	15	0	0	0	0	0	0	0
1993 Near-surface measurements: fall													
1. Main channel	Mean	3.14	0.011	1.755	0.216	0.045	—	—	—	—	—	—	—
	Median	3.141	-0.02	1.738	0.211	0.047	—	—	—	—	—	—	—
	Minimum	1.428	-0.02	1.299	0.157	-0.01	—	—	—	—	—	—	—
	Maximum	4.839	0.023	2.589	0.275	0.064	—	—	—	—	—	—	—
	Std. dev.	0.785	0.003	0.335	0.039	0.016	—	—	—	—	—	—	—
	N obs.	16	16	16	16	16	0	0	0	0	0	0	0

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1993 Near-surface measurements: fall													
2. Side channel	Mean	3.102	0.01	1.799	0.223	0.042	—	—	—	—	—	—	—
	Median	3.018	-0.02	1.557	0.222	0.05	—	—	—	—	—	—	—
	Minimum	2.168	-0.02	1.214	0.173	0.015	—	—	—	—	—	—	—
	Maximum	4.086	-0.02	2.629	0.283	0.065	—	—	—	—	—	—	—
	Std. dev.	0.479	0	0.474	0.033	0.018	—	—	—	—	—	—	—
	N obs.	14	16	16	16	16	0	0	0	0	0	0	0
3. Backwater	Mean	3.133	0.012	1.445	0.237	0.032	—	—	—	—	—	—	—
	Median	3.222	-0.02	1.475	0.222	0.032	—	—	—	—	—	—	—
	Minimum	1	-0.02	-0.01	0.171	-0.01	—	—	—	—	—	—	—
	Maximum	4.423	0.043	3.113	0.412	0.071	—	—	—	—	—	—	—
	Std. dev.	0.809	0.007	0.888	0.056	0.021	—	—	—	—	—	—	—
	N obs.	31	31	31	31	31	0	0	0	0	0	0	0
5. Impounded	Mean	3.071	0.012	1.74	0.223	0.052	—	—	—	—	—	—	—
	Median	3.136	-0.02	1.633	0.203	0.053	—	—	—	—	—	—	—
	Minimum	2.408	-0.02	1.4	0.167	0.032	—	—	—	—	—	—	—
	Maximum	3.619	0.036	2.451	0.379	0.066	—	—	—	—	—	—	—
	Std. dev.	0.329	0.006	0.317	0.055	0.01	—	—	—	—	—	—	—
	N obs.	17	17	17	17	17	0	0	0	0	0	0	0
1994 Near-surface measurements: winter													
1. Main channel	Mean	2.556	0.163	2.364	0.1	0.059	—	—	—	—	—	—	—
	Median	1.992	0.159	2.298	0.09	0.059	—	—	—	—	—	—	—
	Minimum	1.595	0.145	2.164	0.08	0.053	—	—	—	—	—	—	—
	Maximum	6.711	0.188	2.733	0.146	0.064	—	—	—	—	—	—	—
	Std. dev.	1.347	0.013	0.183	0.024	0.003	—	—	—	—	—	—	—
	N obs.	15	15	15	15	15	0	0	0	0	0	0	0
2. Side channel	Mean	2.182	0.156	2.362	0.088	0.055	—	—	—	—	—	—	—
	Median	2.172	0.156	2.319	0.091	0.056	—	—	—	—	—	—	—
	Minimum	1.544	0.123	2.131	0.034	0.039	—	—	—	—	—	—	—
	Maximum	3.153	0.193	2.669	0.106	0.064	—	—	—	—	—	—	—
	Std. dev.	0.453	0.015	0.169	0.017	0.006	—	—	—	—	—	—	—
	N obs.	15	15	15	15	15	0	0	0	0	0	0	0

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1994 Near-surface measurements: winter													
3. Backwater	Mean	2.652	0.261	2.055	0.11	0.038	—	—	—	—	—	—	—
	Median	2.299	0.168	2.346	0.088	0.035	—	—	—	—	—	—	—
	Minimum	1.169	0.078	-0.01	0.055	-0.01	—	—	—	—	—	—	—
	Maximum	5.686	1.27	3.353	0.35	0.077	—	—	—	—	—	—	—
	Std. dev.	1.117	0.26	0.996	0.069	0.021	—	—	—	—	—	—	—
	N obs.	26	27	27	27	27	0	0	0	0	0	0	0
5. Impounded	Mean	3.269	0.171	2.525	0.097	0.055	—	—	—	—	—	—	—
	Median	2.88	0.165	2.401	0.094	0.056	—	—	—	—	—	—	—
	Minimum	1.378	0.135	2.137	0.081	0.036	—	—	—	—	—	—	—
	Maximum	10.25	0.241	3.163	0.128	0.062	—	—	—	—	—	—	—
	Std. dev.	2.032	0.028	0.293	0.012	0.007	—	—	—	—	—	—	—
	N obs.	15	15	15	15	15	0	0	0	0	0	0	0
1994 Near-surface measurements: spring													
1. Main channel	Mean	1.813	0.022	0.198	0.28	0.005	-0.01	—	—	—	—	11.05	37.02
	Median	1.82	-0.02	0.183	0.314	-0.01	-0.05	—	—	—	—	11.56	37.57
	Minimum	0.965	-0.02	0.13	0.129	-0.01	-0.05	—	—	—	—	9.565	34.04
	Maximum	2.252	0.077	0.347	0.386	-0.01	0.18	—	—	—	—	12.33	38.76
	Std. dev.	0.316	0.019	0.068	0.081	0	0.071	—	—	—	—	1	1.42
	N obs.	15	15	15	15	15	15	0	0	0	0	15	15
2. Side channel	Mean	1.902	0.029	0.186	0.283	0.005	0.032	—	—	—	—	10.93	36.19
	Median	1.854	0.024	0.149	0.23	-0.01	-0.05	—	—	—	—	10.81	36.21
	Minimum	1.565	-0.02	-0.01	0.193	-0.01	-0.05	—	—	—	—	9.634	30.6
	Maximum	2.587	0.131	0.351	0.4	-0.01	0.176	—	—	—	—	12.06	39.18
	Std. dev.	0.259	0.03	0.101	0.081	0	0.094	—	—	—	—	0.898	2.481
	N obs.	15	15	15	15	15	15	0	0	0	0	15	15
3. Backwater	Mean	1.825	0.021	0.209	0.211	0.005	0.034	—	—	—	—	11.43	36.72
	Median	1.731	-0.02	0.14	0.195	-0.01	-0.05	—	—	—	—	11.91	38.07
	Minimum	1.408	-0.02	0.12	0.159	-0.01	-0.05	—	—	—	—	3.142	10.52
	Maximum	2.425	0.047	0.62	0.328	-0.01	0.369	—	—	—	—	13.17	43.27
	Std. dev.	0.294	0.013	0.132	0.042	0	0.123	—	—	—	—	1.835	5.688
	N obs.	30	30	30	30	30	30	0	0	0	0	30	30

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1994 Near-surface measurements: spring													
5. Impounded	Mean	1.863	0.023	0.53	0.309	0.005	0.593	—	—	—	—	10.2	34.14
	Median	1.878	0.023	0.528	0.289	-0.01	0.099	—	—	—	—	10.28	33.89
	Minimum	1.6	-0.02	0.147	0.214	-0.01	-0.05	—	—	—	—	6.702	23.28
	Maximum	2.05	0.056	0.965	0.428	-0.01	1.531	—	—	—	—	11.94	38.19
	Std. dev.	0.125	0.014	0.277	0.066	0	0.642	—	—	—	—	1.138	3.596
	N obs.	20	20	20	20	20	20	0	0	0	0	20	20
1994 Near-surface measurements: summer													
1. Main channel	Mean	2.263	0.033	0.89	0.142	0.052	3.932	—	—	—	—	10.18	37.17
	Median	2.219	0.023	0.923	0.13	0.026	4.091	—	—	—	—	10.12	38.48
	Minimum	1.768	-0.02	0.446	0.109	-0.01	1.193	—	—	—	—	8.125	28.03
	Maximum	2.878	0.15	1.336	0.217	0.34	5.244	—	—	—	—	13.2	40.65
	Std. dev.	0.277	0.035	0.299	0.03	0.08	0.993	—	—	—	—	1.507	3.663
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16
2. Side channel	Mean	2.168	0.024	1.131	0.151	0.025	3.722	—	—	—	—	9.666	36.1
	Median	2.13	-0.02	1.076	0.142	0.025	3.977	—	—	—	—	9.237	38.48
	Minimum	1.252	-0.02	0.744	0.023	-0.01	1.164	—	—	—	—	3.274	10.77
	Maximum	3.106	0.054	1.964	0.332	0.063	5.332	—	—	—	—	13.22	41.32
	Std. dev.	0.398	0.017	0.271	0.061	0.018	1.135	—	—	—	—	2.227	7.556
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16
3. Backwater	Mean	1.996	0.034	0.5	0.176	0.037	4.216	—	—	—	—	11.7	38.51
	Median	2.182	0.023	0.502	0.159	0.032	4.706	—	—	—	—	11.76	31.7
	Minimum	1.083	-0.02	-0.01	0.124	0.013	0.972	—	—	—	—	3.061	12.39
	Maximum	2.937	0.176	1.12	0.313	0.091	5.899	—	—	—	—	18.19	139.2
	Std. dev.	0.493	0.036	0.308	0.047	0.022	1.32	—	—	—	—	3.015	27.51
	N obs.	31	31	31	31	29	30	0	0	0	0	30	30
5. Impounded	Mean	1.951	0.039	0.393	0.151	0.029	3.99	—	—	—	—	11.19	36.63
	Median	2.004	0.023	0.3	0.132	0.026	4.237	—	—	—	—	10.99	35.68
	Minimum	0.981	-0.02	-0.01	0.059	-0.01	0.896	—	—	—	—	9.451	26.7
	Maximum	2.332	0.136	0.824	0.254	0.096	4.436	—	—	—	—	12.93	43.87
	Std. dev.	0.323	0.038	0.22	0.057	0.019	0.832	—	—	—	—	0.927	3.834
	N obs.	17	17	17	17	17	17	0	0	0	0	17	17

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1994 Near-surface measurements: fall													
1. Main channel	Mean	1.922	0.029	1.249	0.201	0.059	5.187	—	—	—	—	10.84	25.65
	Median	1.901	0.02	1.2	0.187	0.058	5.206	—	—	—	—	10.48	24.42
	Minimum	1.516	-0.02	1.107	0.146	0.03	4.078	—	—	—	—	8.921	21.94
	Maximum	2.298	0.084	1.675	0.262	0.082	5.977	—	—	—	—	18.72	42.54
	Std. dev.	0.181	0.02	0.157	0.033	0.014	0.425	—	—	—	—	2.24	4.941
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16
2. Side channel	Mean	2.035	0.03	1.32	0.207	0.052	5.272	—	—	—	—	10.73	25.13
	Median	1.959	0.026	1.199	0.199	0.052	5.294	—	—	—	—	10.32	22.98
	Minimum	1.75	-0.02	1.014	0.162	0.027	4.063	—	—	—	—	9.029	22.22
	Maximum	2.554	0.065	2.006	0.333	0.074	5.935	—	—	—	—	14.08	31.82
	Std. dev.	0.21	0.017	0.252	0.044	0.013	0.409	—	—	—	—	1.305	3.279
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16
3. Backwater	Mean	1.912	0.047	1.001	0.22	0.037	4.738	—	—	—	—	11.57	27.06
	Median	1.913	0.032	1.133	0.213	0.041	5.123	—	—	—	—	11.22	26.44
	Minimum	1.048	-0.02	-0.01	0.095	-0.01	2.54	—	—	—	—	9.463	19.54
	Maximum	2.638	0.271	1.788	0.337	0.063	6.29	—	—	—	—	17.14	41.05
	Std. dev.	0.35	0.052	0.544	0.054	0.019	0.972	—	—	—	—	1.494	4.345
	N obs.	32	32	32	32	32	32	0	0	0	0	32	32
5. Impounded	Mean	2.087	0.051	1.346	0.165	0.062	5.364	—	—	—	—	11.78	25.72
	Median	2.056	0.052	1.369	0.163	0.061	5.336	—	—	—	—	11.69	25.94
	Minimum	1.75	-0.02	1.134	0.125	0.044	5.082	—	—	—	—	10.1	22.17
	Maximum	2.492	0.078	1.557	0.215	0.084	5.599	—	—	—	—	13.23	28.33
	Std. dev.	0.221	0.018	0.156	0.03	0.01	0.168	—	—	—	—	0.816	1.812
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16
1995 Near-surface measurements: winter													
1. Main channel	Mean	2.391	0.066	1.86	0.078	0.011	5.631	—	—	—	—	14.01	28.42
	Median	2.373	0.065	1.871	0.075	0.013	5.601	—	—	—	—	13.92	28.4
	Minimum	2.262	0.032	1.098	0.039	-0.01	4.959	—	—	—	—	9.19	21.21
	Maximum	2.625	0.095	2.108	0.148	0.02	6.168	—	—	—	—	15.77	32.76
	Std. dev.	0.097	0.018	0.229	0.027	0.005	0.289	—	—	—	—	1.569	2.317
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1995 Near-surface measurements: winter													
2. Side channel	Mean	2.565	0.065	2.12	0.07	0.011	5.474	—	—	—	—	14.96	29.28
	Median	2.457	0.065	2.054	0.069	-0.01	5.499	—	—	—	—	14.73	29.09
	Minimum	2.204	0.044	1.784	0.032	-0.01	4.821	—	—	—	—	13.41	26.79
	Maximum	3.252	0.089	2.965	0.129	0.046	5.8	—	—	—	—	16.21	34.65
	Std. dev.	0.311	0.012	0.37	0.023	0.01	0.236	—	—	—	—	0.984	1.755
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16
3. Backwater	Mean	2.439	0.19	2.048	0.072	0.011	5.038	—	—	—	—	15.26	27
	Median	2.347	0.065	1.859	0.059	0.01	5.38	—	—	—	—	14.79	29.22
	Minimum	0.815	0.04	0.164	0.013	-0.01	2.802	—	—	—	—	12.49	11.82
	Maximum	3.799	0.815	6.992	0.167	0.027	6.212	—	—	—	—	19.91	31.36
	Std. dev.	0.629	0.247	1.463	0.042	0.007	0.866	—	—	—	—	1.672	4.911
	N obs.	24	24	24	24	24	24	0	0	0	0	24	24
5. Impounded	Mean	2.655	0.082	2.533	0.075	0.008	5.038	—	—	—	—	14.56	29.43
	Median	2.71	0.068	2.328	0.049	-0.01	5.485	—	—	—	—	14.37	29.4
	Minimum	2.321	0.055	1.912	0.031	-0.01	0.055	—	—	—	—	13.5	28.23
	Maximum	2.859	0.247	6.296	0.212	0.018	5.937	—	—	—	—	16.2	30.76
	Std. dev.	0.182	0.047	1.059	0.052	0.005	1.434	—	—	—	—	0.746	0.68
	N obs.	15	15	15	15	15	15	0	0	0	0	15	14
1995 Near-surface measurements: spring													
1. Main channel	Mean	2.842	0.022	2.411	0.124	0.007	3.256	—	—	—	—	13.73	46.7
	Median	2.768	0.023	2.347	0.119	-0.01	3.366	—	—	—	—	14.07	47.66
	Minimum	2.197	-0.02	1.845	0.066	-0.01	2.369	—	—	—	—	12.37	41.33
	Maximum	4.084	0.037	3.584	0.174	0.014	4.008	—	—	—	—	15.57	51.72
	Std. dev.	0.463	0.007	0.49	0.032	0.004	0.448	—	—	—	—	1.099	3.594
	N obs.	16	16	16	16	16	14	0	0	0	0	14	14
2. Side channel	Mean	2.813	0.026	2.353	0.148	0.01	2.85	—	—	—	—	11.92	40.67
	Median	2.761	0.025	1.982	0.133	-0.01	3.027	—	—	—	—	12.32	42.62
	Minimum	2.076	-0.02	1.432	0.079	-0.01	1.731	—	—	—	—	5.203	20.69
	Maximum	4.598	0.043	3.735	0.258	0.02	3.463	—	—	—	—	15.02	49.82
	Std. dev.	0.596	0.01	0.67	0.052	0.005	0.492	—	—	—	—	2.599	7.792
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1995 Near-surface measurements: spring													
3. Backwater	Mean	2.67	0.032	1.978	0.166	0.007	2.391	—	—	—	—	11.73	36.4
	Median	2.702	0.033	1.85	0.141	-0.01	2.624	—	—	—	—	12.12	38.42
	Minimum	0.78	-0.02	0.212	0.084	-0.01	-0.05	—	—	—	—	6.344	21.92
	Maximum	4.756	0.057	3.868	0.311	0.02	4.027	—	—	—	—	14.44	43.6
	Std. dev.	0.735	0.009	0.731	0.064	0.004	0.92	—	—	—	—	1.69	6.273
	N obs.	32	32	32	32	32	29	0	0	0	0	29	29
5. Impounded	Mean	3.118	0.025	2.691	0.124	0.008	3.513	—	—	—	—	14.22	47.05
	Median	2.986	0.027	2.591	0.113	-0.01	3.55	—	—	—	—	14.06	47.72
	Minimum	2.428	-0.02	1.794	0.08	-0.01	3.158	—	—	—	—	12.66	42.19
	Maximum	4.202	0.048	4.462	0.208	0.015	3.744	—	—	—	—	15.99	49.34
	Std. dev.	0.471	0.011	0.666	0.036	0.004	0.209	—	—	—	—	0.964	2.377
	N obs.	16	16	16	16	16	10	0	0	0	0	10	10
1995 Near-surface measurements: summer													
1. Main channel	Mean	2.379	0.055	1.29	0.208	0.08	5.415	—	—	—	—	16.59	57.09
	Median	2.295	0.046	1.323	0.203	0.085	5.414	—	—	—	—	12.46	45.63
	Minimum	2.121	0.022	-0.01	0.172	0.047	5.072	—	—	—	—	11.57	20.52
	Maximum	2.652	0.099	1.865	0.235	0.106	5.814	—	—	—	—	47.3	155.3
	Std. dev.	0.181	0.024	0.407	0.019	0.017	0.195	—	—	—	—	9.191	30.06
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16
2. Side channel	Mean	2.389	0.074	0.941	0.216	0.091	5.585	—	—	—	—	17.2	59.29
	Median	2.362	0.069	1.199	0.211	0.101	5.568	—	—	—	—	16.52	55.82
	Minimum	2.159	0.033	-0.01	0.191	0.053	5.169	—	—	—	—	10.98	38.34
	Maximum	2.733	0.169	1.541	0.259	0.124	5.989	—	—	—	—	28.04	96.09
	Std. dev.	0.175	0.04	0.581	0.018	0.026	0.209	—	—	—	—	4.592	14.83
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16
3. Backwater	Mean	2.425	0.07	0.929	0.32	0.099	5.659	—	—	—	—	16.34	51.09
	Median	2.322	0.044	1.075	0.27	0.097	5.595	—	—	—	—	13.82	48.82
	Minimum	1.643	-0.02	-0.01	0.151	0.035	1.988	—	—	—	—	9.889	8.293
	Maximum	4.545	0.184	1.845	1.134	0.264	9.725	—	—	—	—	32.78	98.66
	Std. dev.	0.492	0.051	0.564	0.176	0.047	1.166	—	—	—	—	5.251	20.44
	N obs.	32	32	32	32	32	32	0	0	0	0	32	32

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1995 Near-surface measurements: summer													
5. Impounded	Mean	2.227	0.053	1.108	0.225	0.096	5.463	—	—	—	—	13.65	47.56
	Median	2.198	0.043	1.242	0.213	0.096	5.449	—	—	—	—	12.62	44.94
	Minimum	2.02	0.022	-0.01	0.176	0.073	5.134	—	—	—	—	11.81	43.24
	Maximum	2.416	0.1	1.552	0.278	0.117	5.867	—	—	—	—	20.16	62.74
	Std. dev.	0.13	0.024	0.401	0.029	0.01	0.224	—	—	—	—	2.378	6.106
	N obs.	16	16	16	16	16	16	0	0	0	0	16	16
1995 Near-surface measurements: fall													
1. Main channel	Mean	1.655	0.059	0.8	0.128	0.038	—	—	—	—	—	—	—
	Median	1.616	0.055	0.812	0.128	0.039	—	—	—	—	—	—	—
	Minimum	1.404	0.043	0.611	0.098	0.03	—	—	—	—	—	—	—
	Maximum	1.97	0.085	1.023	0.158	0.044	—	—	—	—	—	—	—
	Std. dev.	0.178	0.012	0.16	0.017	0.005	—	—	—	—	—	—	—
	N obs.	18	18	18	18	18	0	0	0	0	0	0	0
2. Side channel	Mean	1.683	0.057	0.803	0.132	0.037	—	—	—	—	—	—	—
	Median	1.728	0.058	0.771	0.128	0.036	—	—	—	—	—	—	—
	Minimum	1.379	-0.02	0.575	0.1	0.023	—	—	—	—	—	—	—
	Maximum	2.009	0.08	1.115	0.179	0.05	—	—	—	—	—	—	—
	Std. dev.	0.198	0.017	0.176	0.021	0.008	—	—	—	—	—	—	—
	N obs.	16	16	16	16	16	0	0	0	0	0	0	0
3. Backwater	Mean	1.526	0.048	0.599	0.135	0.035	—	—	—	—	—	—	—
	Median	1.541	0.046	0.592	0.135	0.037	—	—	—	—	—	—	—
	Minimum	1.013	0.03	0.018	0.084	-0.01	—	—	—	—	—	—	—
	Maximum	1.943	0.074	1.097	0.173	0.057	—	—	—	—	—	—	—
	Std. dev.	0.238	0.013	0.264	0.024	0.013	—	—	—	—	—	—	—
	N obs.	33	33	33	33	33	0	0	0	0	0	0	0
5. Impounded	Mean	1.899	0.064	1.033	0.129	0.036	—	—	—	—	—	—	—
	Median	1.849	0.061	1.012	0.123	0.035	—	—	—	—	—	—	—
	Minimum	1.725	0.036	0.916	0.099	0.029	—	—	—	—	—	—	—
	Maximum	2.125	0.085	1.146	0.215	0.045	—	—	—	—	—	—	—
	Std. dev.	0.118	0.012	0.083	0.028	0.005	—	—	—	—	—	—	—
	N obs.	16	16	16	16	16	0	0	0	0	0	0	0

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1996 Near-surface measurements: winter													
1. Main channel	Mean	2.48	0.314	1.713	0.087	0.046	6.792	—	—	—	—	14.22	31.15
	Median	2.462	0.322	1.717	0.087	0.047	6.777	—	—	—	—	14.94	31.86
	Minimum	2.076	0.247	1.564	0.07	0.031	6.609	—	—	—	—	10.05	23.43
	Maximum	2.791	0.373	2.028	0.099	0.061	6.973	—	—	—	—	15.95	35.09
	Std. dev.	0.181	0.032	0.119	0.009	0.009	0.134	—	—	—	—	1.937	3.635
	N obs.	16	16	16	16	16	7	0	0	0	0	7	7
2. Side channel	Mean	2.67	0.378	1.86	0.11	0.067	6.679	—	—	—	—	13.48	29.45
	Median	2.523	0.325	1.629	0.088	0.044	6.823	—	—	—	—	14.58	32.52
	Minimum	2.35	0.253	1.546	0.068	0.024	5.589	—	—	—	—	-0.01	-0
	Maximum	3.532	0.954	3.028	0.351	0.278	7.012	—	—	—	—	16.3	36.5
	Std. dev.	0.358	0.172	0.463	0.075	0.068	0.408	—	—	—	—	4.539	10.2
	N obs.	17	17	17	17	17	11	0	0	0	0	11	11
3. Backwater	Mean	2.929	0.461	2.038	0.136	0.058	6.418	—	—	—	—	15.46	30.92
	Median	2.914	0.395	2.059	0.105	0.052	6.092	—	—	—	—	15.02	29.29
	Minimum	2.295	0.135	-0.01	0.042	-0.01	5.188	—	—	—	—	14.44	28.61
	Maximum	3.737	1.31	4.186	0.723	0.188	8.216	—	—	—	—	17.69	35.7
	Std. dev.	0.371	0.227	0.743	0.118	0.04	1.031	—	—	—	—	1.201	2.93
	N obs.	31	31	31	31	31	6	0	0	0	0	6	6
5. Impounded	Mean	2.925	0.305	1.975	0.095	0.049	6.459	—	—	—	—	16.68	34.6
	Median	2.795	0.279	1.918	0.089	0.044	6.994	—	—	—	—	15.69	35.36
	Minimum	2.552	0.099	1.581	0.062	0.021	0.086	—	—	—	—	13.3	27.94
	Maximum	3.488	0.588	2.537	0.197	0.158	7.951	—	—	—	—	27.84	36.14
	Std. dev.	0.337	0.099	0.296	0.029	0.031	2.064	—	—	—	—	3.686	2.319
	N obs.	16	16	16	16	16	12	0	0	0	0	12	11
1996 Near-surface measurements: spring													
1. Main channel	Mean	1.938	—	0.97	0.139	0.052	—	—	—	—	—	—	—
	Median	1.977	—	1.061	0.14	0.051	—	—	—	—	—	—	—
	Minimum	0.684	—	0.029	0.118	0.038	—	—	—	—	—	—	—
	Maximum	3.819	—	1.267	0.151	0.092	—	—	—	—	—	—	—
	Std. dev.	0.712	—	0.354	0.01	0.012	—	—	—	—	—	—	—
	N obs.	16	0	16	10	16	0	0	0	0	0	0	0

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1996 Near-surface measurements: spring													
2. Side channel	Mean	1.898	—	1.083	0.123	0.047	—	—	—	—	—	—	—
	Median	1.945	—	1.032	0.122	0.045	—	—	—	—	—	—	—
	Minimum	1.485	—	0.921	0.084	0.039	—	—	—	—	—	—	—
	Maximum	2.237	—	1.444	0.149	0.055	—	—	—	—	—	—	—
	Std. dev.	0.223	—	0.132	0.018	0.005	—	—	—	—	—	—	—
	N obs.	16	0	16	10	16	0	0	0	0	0	0	0
3. Backwater	Mean	1.589	—	0.761	0.119	0.043	—	—	—	—	—	—	—
	Median	1.62	—	0.61	0.116	0.044	—	—	—	—	—	—	—
	Minimum	0.675	—	-0.01	0.024	0.028	—	—	—	—	—	—	—
	Maximum	2.51	—	1.232	0.192	0.053	—	—	—	—	—	—	—
	Std. dev.	0.5	—	0.342	0.038	0.006	—	—	—	—	—	—	—
	N obs.	31	0	32	14	32	0	0	0	0	0	0	0
5. Impounded	Mean	1.645	—	0.749	0.149	0.042	—	—	—	—	—	—	—
	Median	1.48	—	0.515	0.152	0.042	—	—	—	—	—	—	—
	Minimum	0.612	—	0.137	0.139	0.034	—	—	—	—	—	—	—
	Maximum	2.597	—	1.185	0.157	0.051	—	—	—	—	—	—	—
	Std. dev.	0.576	—	0.368	0.009	0.005	—	—	—	—	—	—	—
	N obs.	15	0	16	3	16	0	0	0	0	0	0	0
1996 Near-surface measurements: summer													
1. Main channel	Mean	2.135	0.055	1.24	—	0.04	—	—	—	—	—	—	—
	Median	2.164	0.054	1.352	—	0.039	—	—	—	—	—	—	—
	Minimum	1.69	-0.02	0.792	—	0.02	—	—	—	—	—	—	—
	Maximum	2.679	0.091	1.758	—	0.067	—	—	—	—	—	—	—
	Std. dev.	0.274	0.025	0.288	—	0.013	—	—	—	—	—	—	—
	N obs.	19	19	19	0	19	0	0	0	0	0	0	0
2. Side channel	Mean	2.056	0.053	1.157	—	0.046	—	—	—	—	—	—	—
	Median	1.998	0.045	1.091	—	0.042	—	—	—	—	—	—	—
	Minimum	1.623	-0.02	0.813	—	0.024	—	—	—	—	—	—	—
	Maximum	2.551	0.135	1.929	—	0.081	—	—	—	—	—	—	—
	Std. dev.	0.262	0.036	0.333	—	0.015	—	—	—	—	—	—	—
	N obs.	17	17	17	0	17	0	0	0	0	0	0	0

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
1996 Near-surface measurements: summer													
3. Backwater	Mean	1.949	0.058	0.702	—	0.051	—	—	—	—	—	—	—
	Median	1.902	0.038	0.767	—	0.037	—	—	—	—	—	—	—
	Minimum	0.666	-0.02	-0.01	—	-0.01	—	—	—	—	—	—	—
	Maximum	3.308	0.261	1.973	—	0.203	—	—	—	—	—	—	—
	Std. dev.	0.514	0.066	0.592	—	0.043	—	—	—	—	—	—	—
	N obs.	32	32	32	0	32	0	0	0	0	0	0	0
5. Impounded	Mean	2.054	0.013	1.143	—	0.042	—	—	—	—	—	—	—
	Median	2.091	-0.02	1.149	—	0.04	—	—	—	—	—	—	—
	Minimum	1.656	-0.02	0.838	—	0.019	—	—	—	—	—	—	—
	Maximum	2.38	0.045	1.533	—	0.074	—	—	—	—	—	—	—
	Std. dev.	0.227	0.009	0.198	—	0.013	—	—	—	—	—	—	—
	N obs.	16	16	16	0	16	0	0	0	0	0	0	0
1996 Near-surface measurements: fall													
1. Main channel	Mean	0.857	0.063	0.356	0.088	0.018	—	—	—	—	—	—	—
	Median	0.813	0.061	0.3	0.088	0.016	—	—	—	—	—	—	—
	Minimum	0.701	-0.02	0.195	0.063	-0.01	—	—	—	—	—	—	—
	Maximum	1.156	0.129	0.718	0.114	0.029	—	—	—	—	—	—	—
	Std. dev.	0.129	0.032	0.145	0.014	0.008	—	—	—	—	—	—	—
	N obs.	16	16	16	16	16	0	0	0	0	0	0	0
2. Side channel	Mean	0.926	0.061	0.363	0.1	0.018	—	—	—	—	—	—	—
	Median	0.897	0.061	0.348	0.092	0.017	—	—	—	—	—	—	—
	Minimum	0.762	-0.02	0.241	0.062	-0.01	—	—	—	—	—	—	—
	Maximum	1.159	0.098	0.627	0.198	0.038	—	—	—	—	—	—	—
	Std. dev.	0.111	0.02	0.103	0.031	0.009	—	—	—	—	—	—	—
	N obs.	16	16	16	16	16	0	0	0	0	0	0	0
3. Backwater	Mean	1.126	0.035	0.299	0.177	0.018	—	—	—	—	—	—	—
	Median	1.037	0.024	0.296	0.146	0.013	—	—	—	—	—	—	—
	Minimum	0.637	-0.02	-0.01	0.074	-0.01	—	—	—	—	—	—	—
	Maximum	1.875	0.1	0.934	0.598	0.093	—	—	—	—	—	—	—
	Std. dev.	0.302	0.028	0.275	0.109	0.021	—	—	—	—	—	—	—
	N obs.	33	33	33	33	33	0	0	0	0	0	0	0

Table F-2. Continued.

Sampling stratum	Statistic	Total nitrogen (N mg/L)	Ammonium (N mg/L)	Nitrate–nitrite (N mg/L)	Total phosphorus (P mg/L)	Soluble reactive P (P mg/L)	Silica (Si mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
						1996 Near-surface measurements: fall							
5. Impounded	Mean	0.858	0.048	0.35	0.147	0.015	—	—	—	—	—	—	—
	Median	0.837	0.043	0.362	0.083	0.014	—	—	—	—	—	—	—
	Minimum	0.646	-0.02	0.195	0.062	-0.01	—	—	—	—	—	—	—
	Maximum	1.097	0.103	0.484	0.78	0.04	—	—	—	—	—	—	—
	Std. dev.	0.113	0.033	0.074	0.192	0.011	—	—	—	—	—	—	—
	N obs.	18	18	18	18	18	0	0	0	0	0	0	0

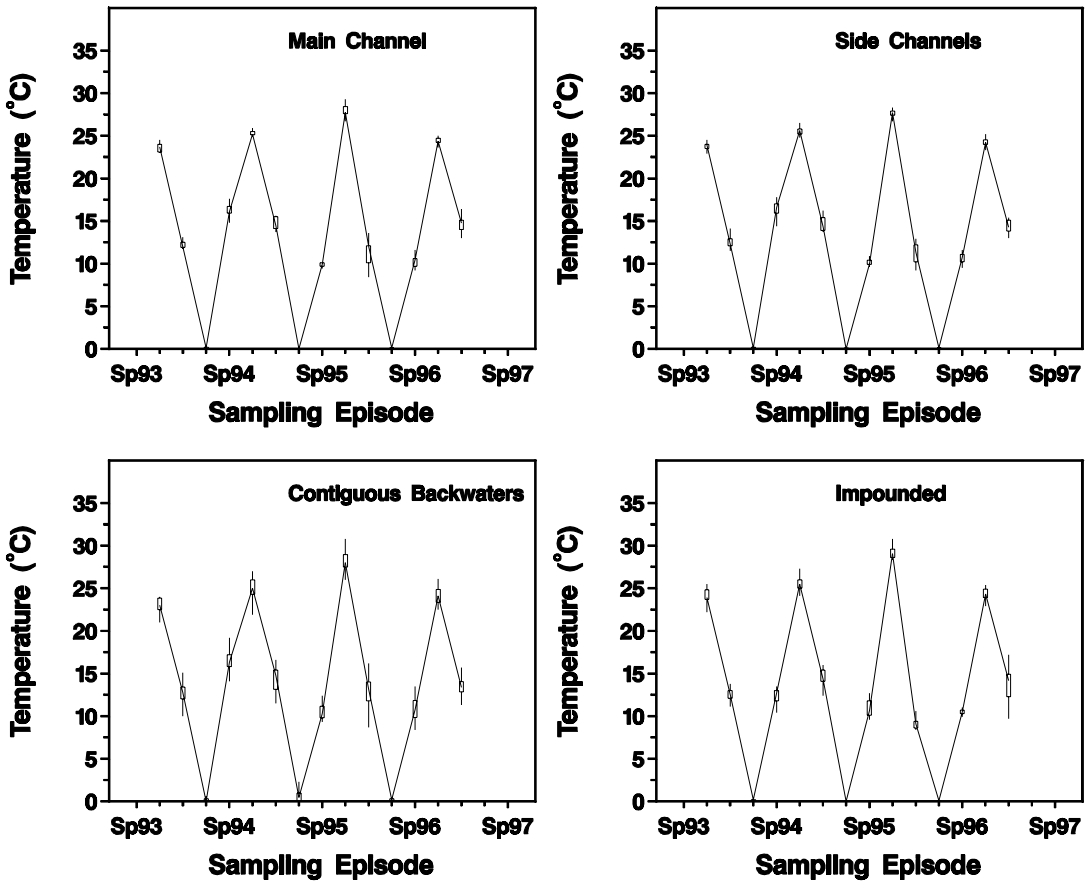

Figure F-1. Water temperature (°C) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

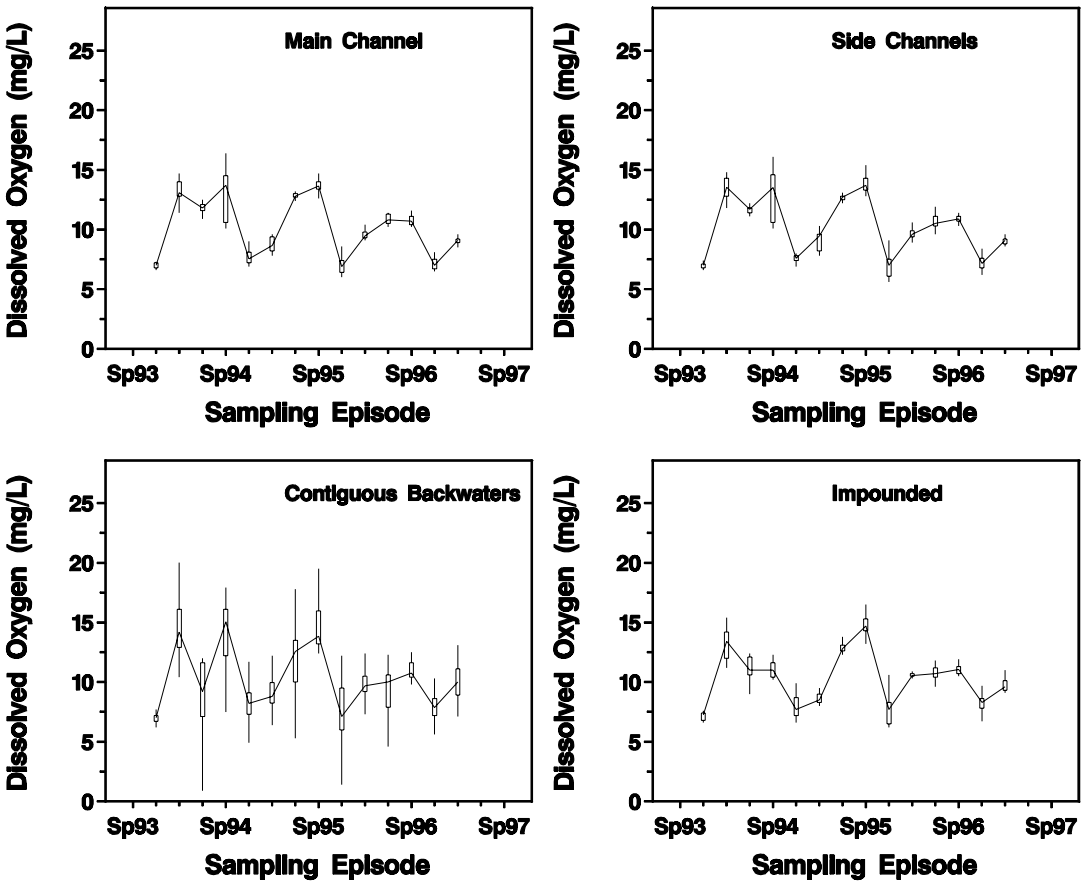

Figure F-2. Dissolved oxygen (mg/L) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

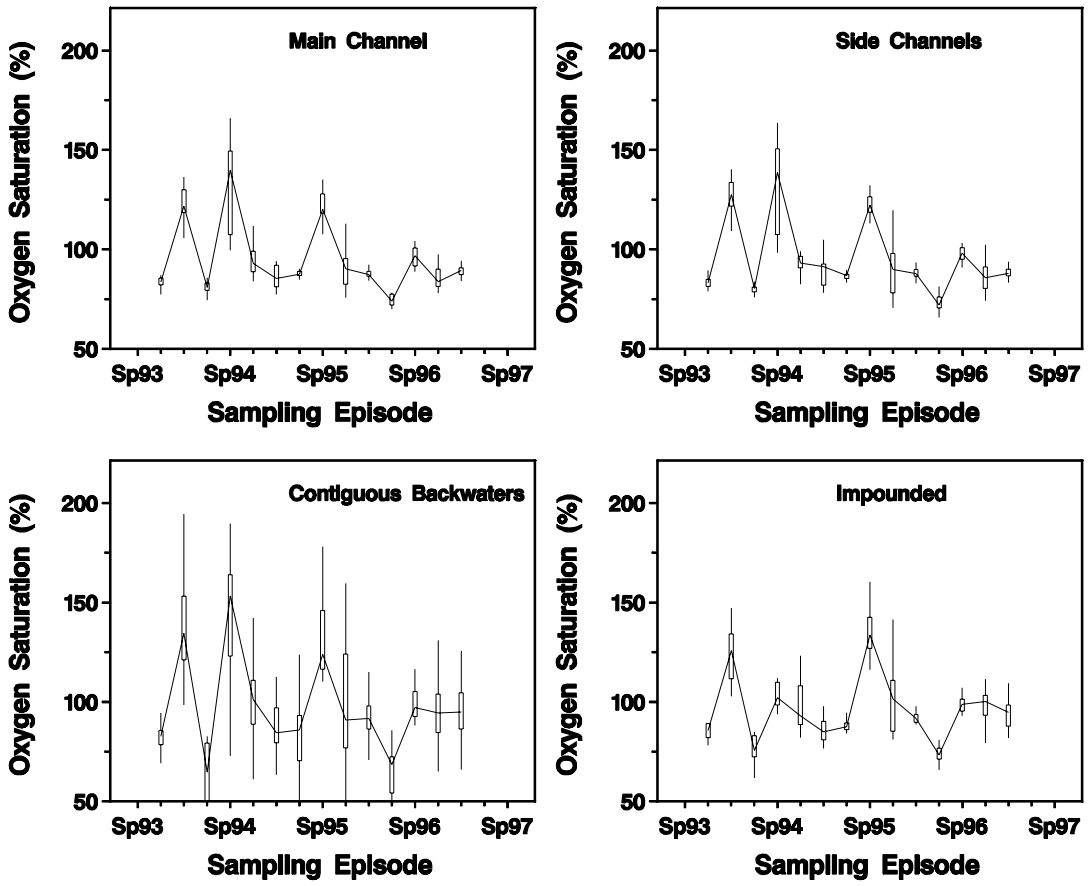

Figure F-3. Dissolved oxygen saturation (%) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

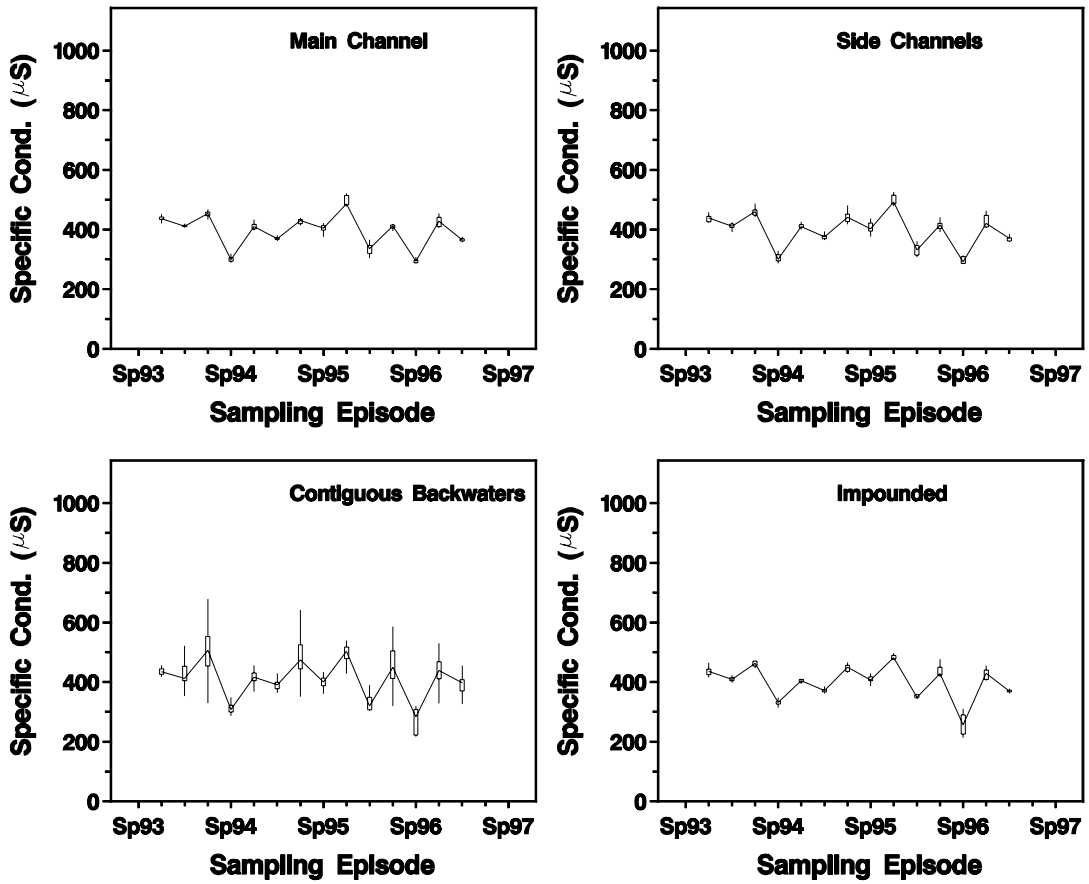

Figure F-4. Specific conductivity (µS) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

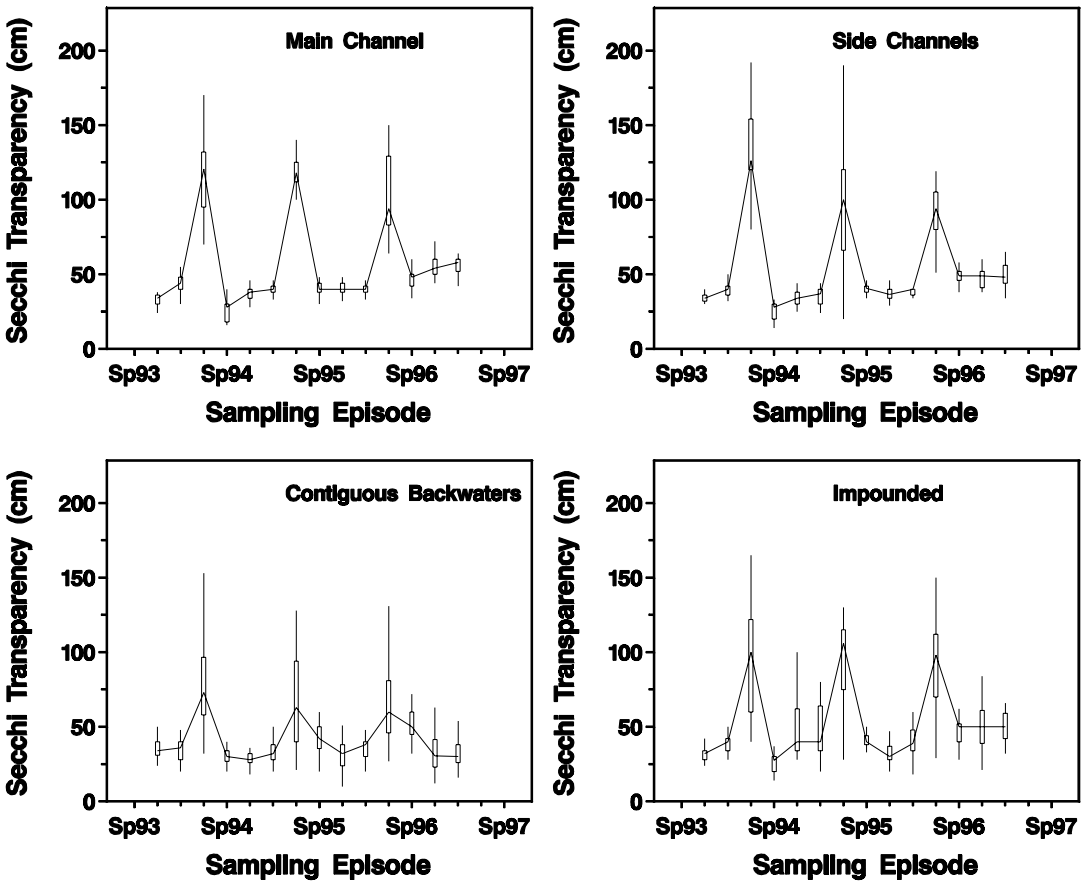

Figure F-5. Secchi transparency (cm) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

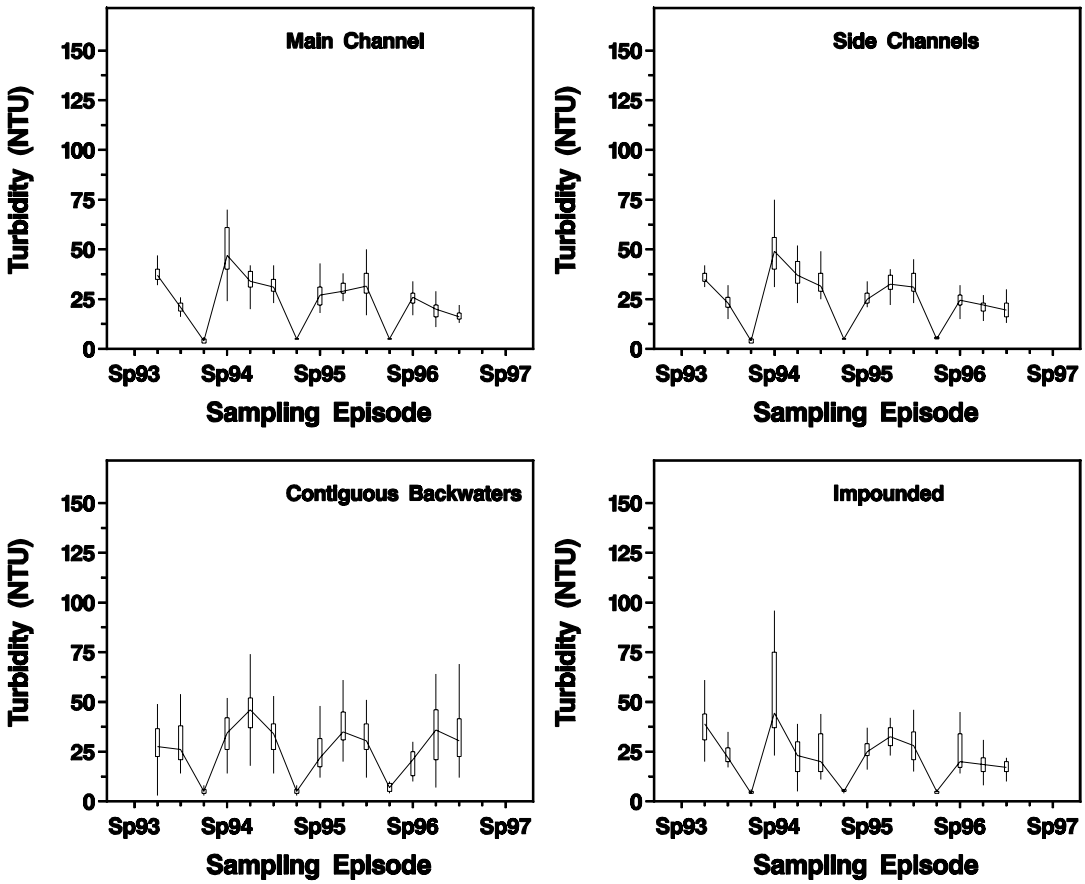

Figure F-6. Turbidity (NTU) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

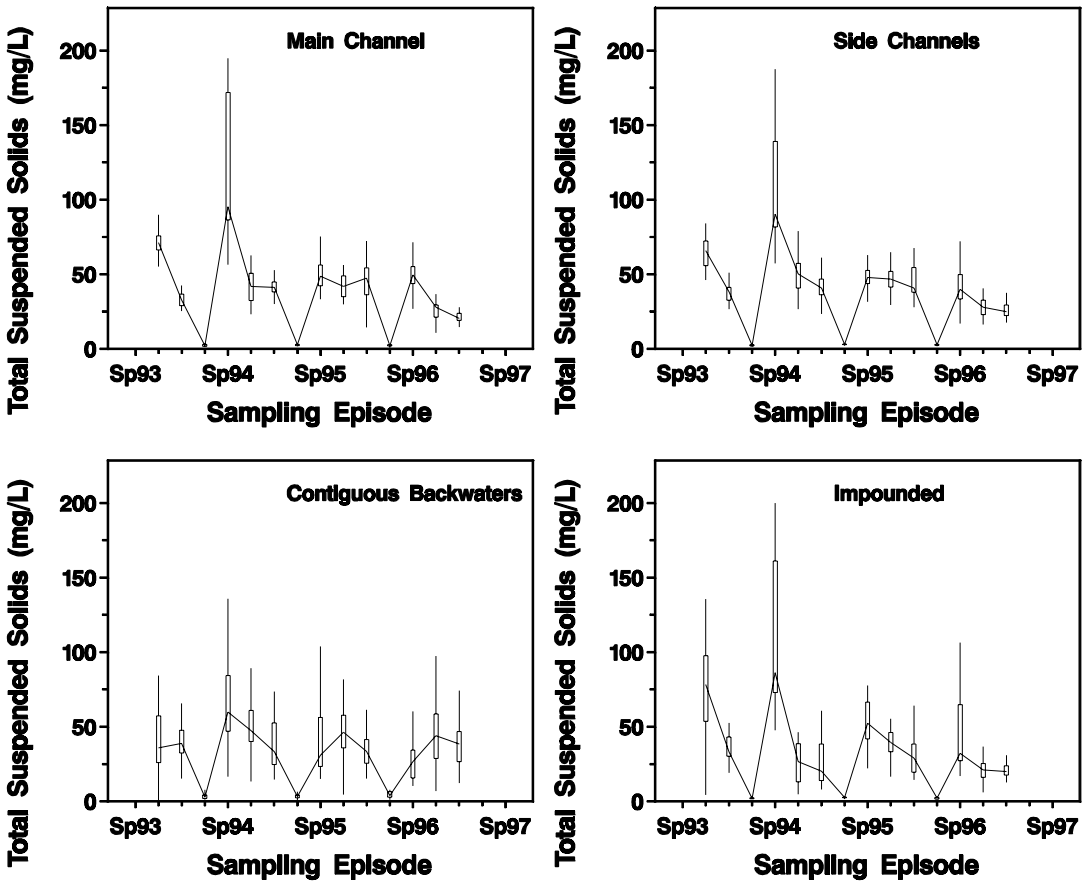

Figure F-7. Total suspended solids (mg/L) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

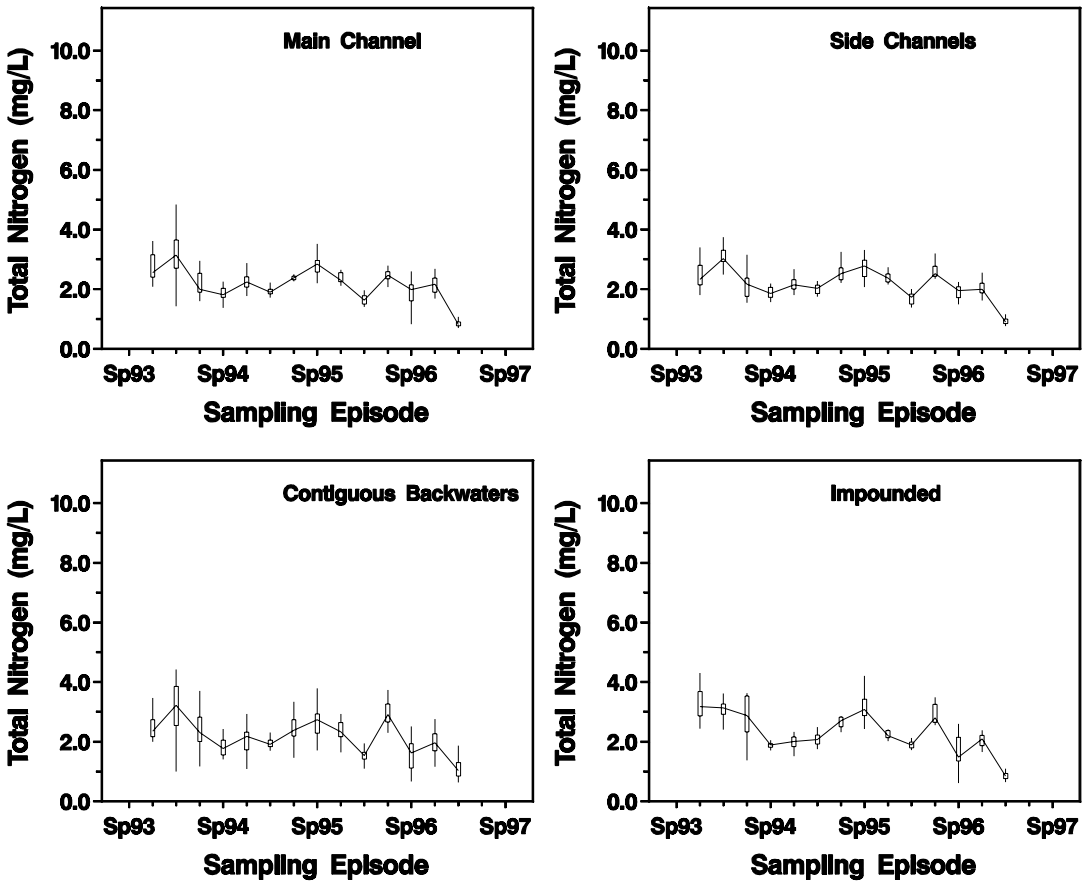

Figure F-8. Total nitrogen (mg/L) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

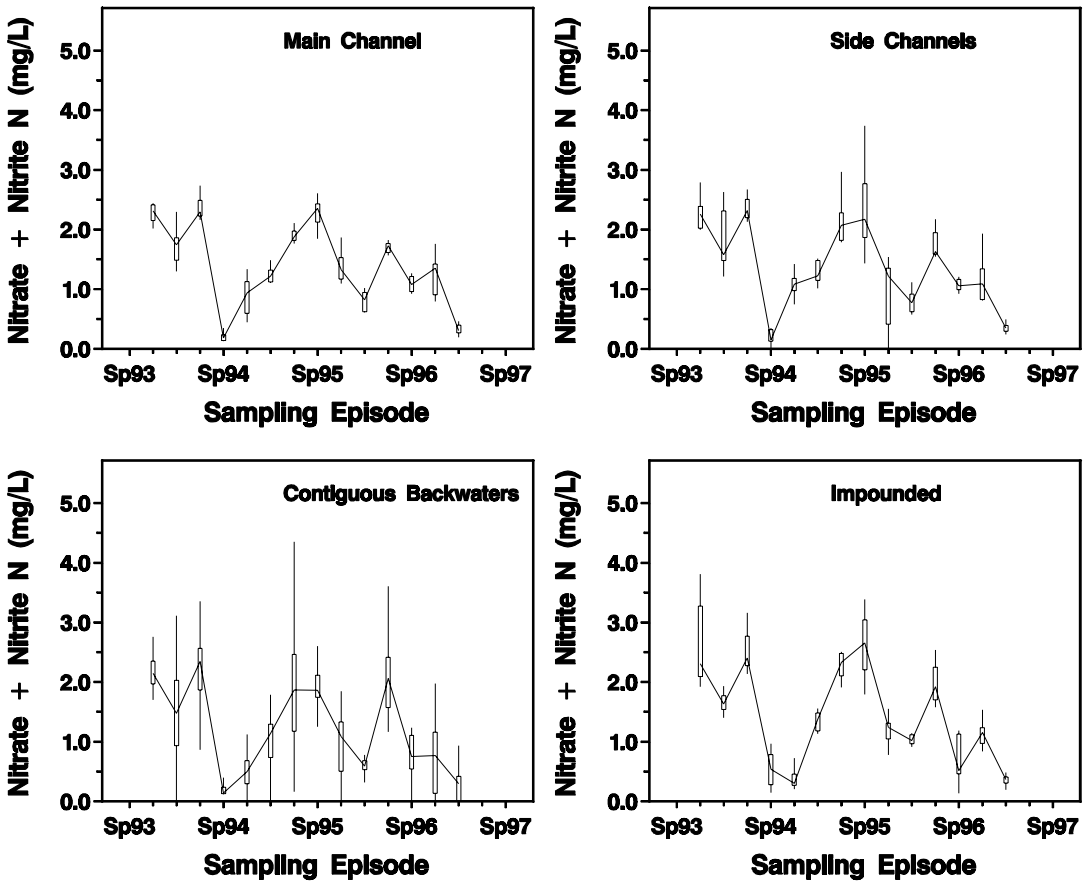

Figure F-9. Nitrate–nitrite nitrogen (mg/L) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

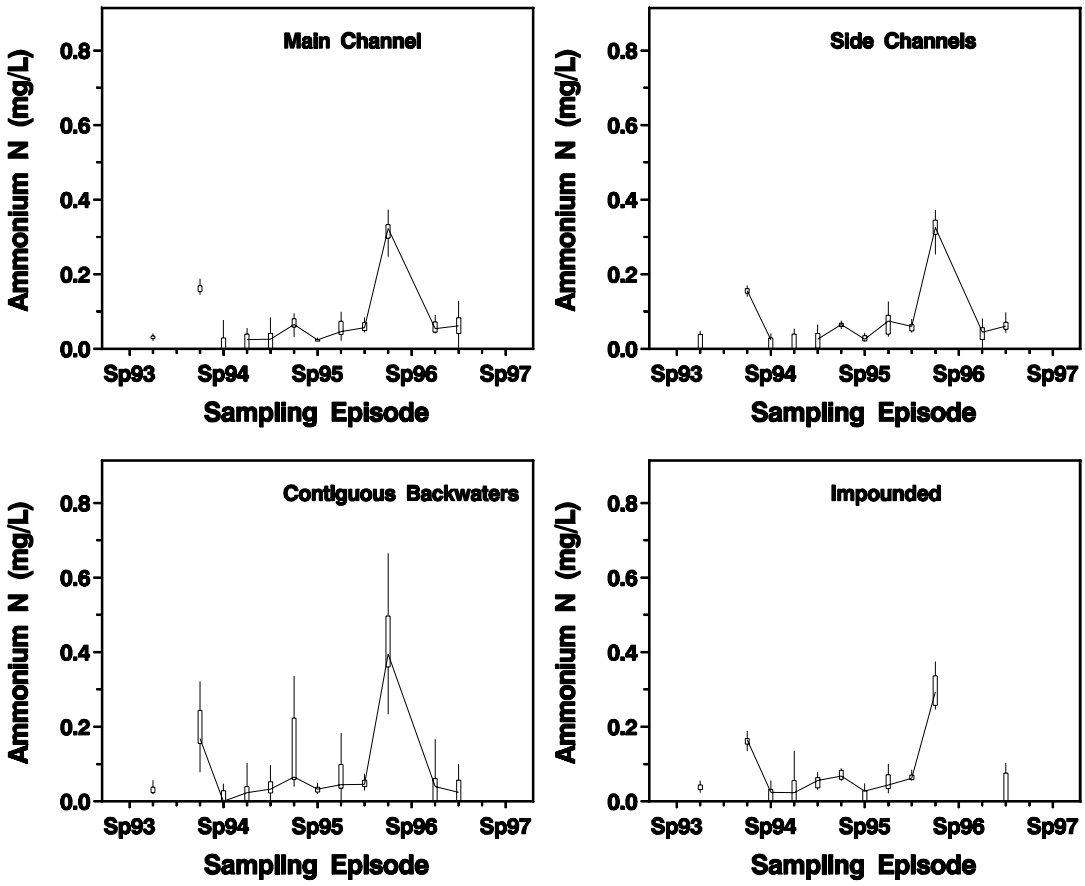

Figure F-10. Ammonium nitrogen (mg/L) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

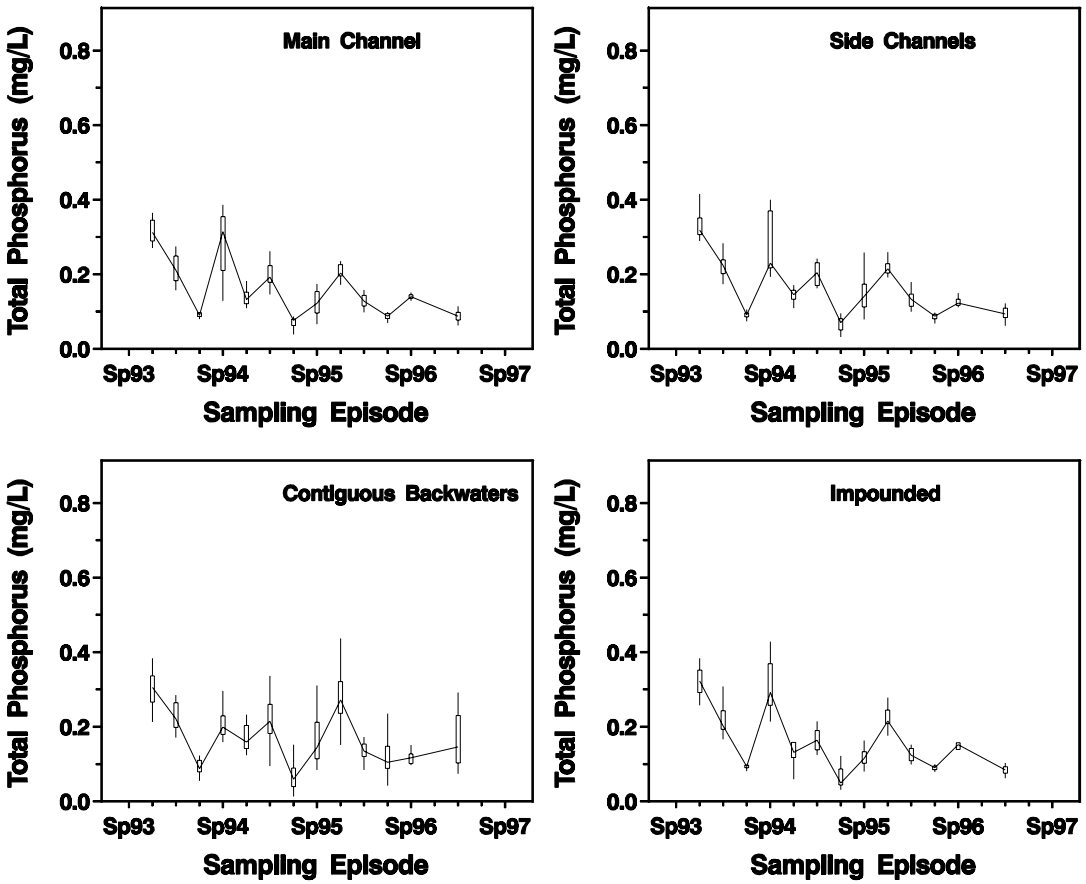

Figure F-11. Total phosphorus (mg/L) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

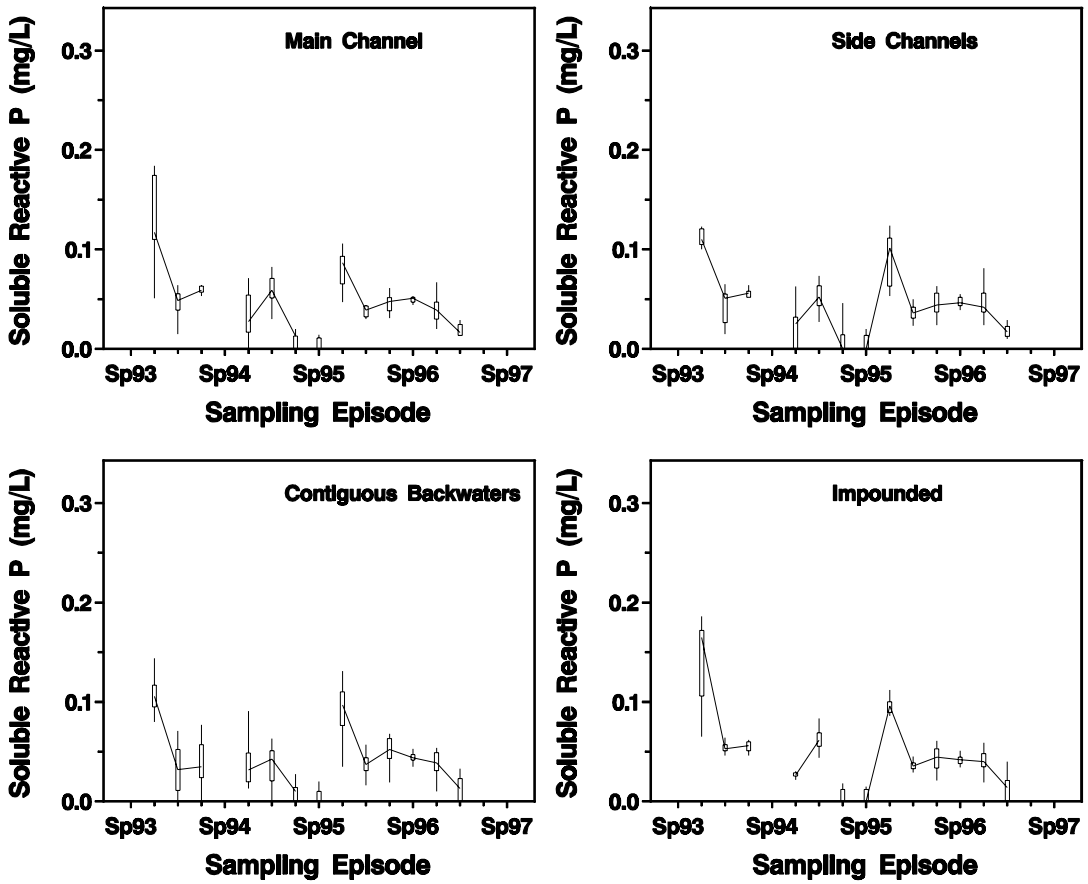

Figure F-12. Soluble reactive phosphorus (mg/L) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

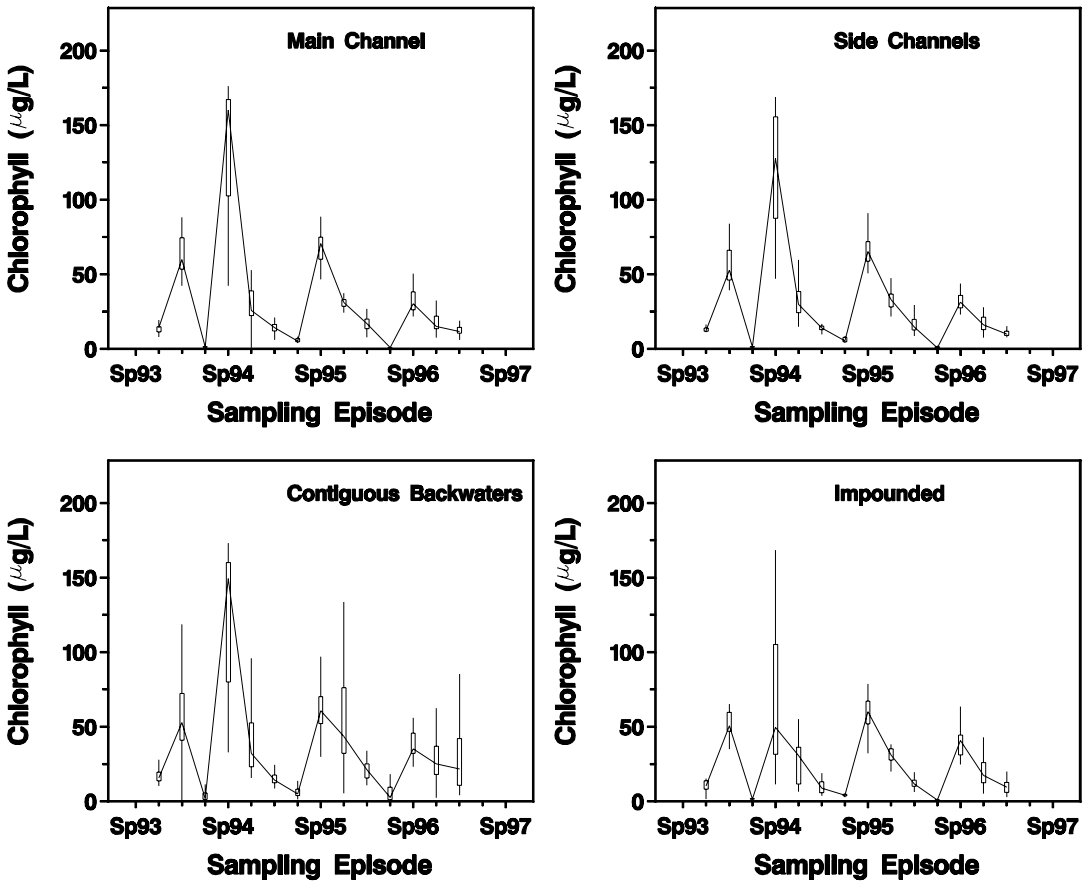

Figure F-13. Fluorometric chlorophyll *a* (µg/L) in stratified random sampling episodes from spring 1993 (Sp93) through fall 1996. Each sampling stratum is plotted separately. A solid line connects the medians of each episode, the 90th and 10th percentiles of the data are shown by the upper and lower extent of the box, and vertical lines extend to the maximum and minimum values (or to the limits of the plotting axis).

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13. ABSTRACT (Maximum 200 words) Since 1988, the Long Term Resource Monitoring Program (LTRMP) staff have performed basic limnological field measurements in the Upper Mississippi River System. The period of this report (1993–96) includes a major revision of the LTRMP sampling design in 1993 that added randomization, broader spatial coverage, and increased monitoring of tributaries and locations that allow monitoring of material transport. Several short-term trends were noted during 1993–96. Total nitrogen, nitrate–nitrite nitrogen, soluble reactive phosphorus, total phosphorus, and turbidity generally decreased while ammonia increased in all study pools (12, 13, and 14). Sediment and plant nutrient concentrations were higher in two tributaries (the Maquoketa and Wapsipinicon Rivers, Iowa) than in the main channel of the Mississippi River.			
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The Long Term Resource Monitoring Program (LTRMP) for the Upper Mississippi River System was authorized under the Water Resources Development Act of 1986 as an element of the Environmental Management Program. The mission of the LTRMP is to provide river managers with information for maintaining the Upper Mississippi River System as a sustainable large river ecosystem given its multiple-use character. The LTRMP is a cooperative effort by the U.S. Geological Survey, the U.S. Army Corps of Engineers, and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin.